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Ottawa, 1874.

CANADIAN PACIFIC RAILWAY.

Sandford Fleming, Engineer-in-Chief.

REPORT OF PROGRESS

ON THE

EXPLORATIONS AND SURVEYS

UP TO

JANUARY, 1874,

Ottawa:
PRINTED BY MACLEAN, ROGER & CO., "TIMES" OFFICE.
1874.

Canadian Pacific Railway. Report of progress on the explorations and surveys up to Jan. 1874. *With large folding maps.* 8vo, sewn, *also case of maps, 2 maps in report torn,* 60c. Ottawa, 1874. 16

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CANADIAN PACIFIC RAILWAY,

OFFICE OF THE ENGINEER IN CHIEF,

SIR,—

I have the honour to transmit, for the information of His Excellency the Governor General in Council, the accompanying Report with Appendices and Diagrams, relating to the Surveys and Investigations, made in connection with the projected Canadian Pacific Railway.

I have the honour to be,
Sir,
Your obedient servant,
SANDFORD FLEMING,
Engineer-in-Chief.

To

The Honourable ALEXANDER MACKENZIE,
Premier and Minister of Public Works,
Canada.

Canadian Pacific Railway.

REPORT OF THE ENGINEER-IN-CHIEF

JANUARY, 1874.

EXPLORATORY SURVEY.

CANADIAN PACIFIC RAILWAY

REPORT,

BY

Sandford Fleming,

Engineer-in-Chief,

ADDRESSED TO

THE HON. ALEXANDER MACKENZIE,

Minister of Public Works, &c.

OFFICE OF THE ENGINEER-IN-CHIEF,
OTTAWA, January 26th, 1874.

SIR,

I have the honour to submit the following information respecting the explorations and surveys, which have been made under my direction, in connection with the projected line of railway from the Provinces of Ontario and Quebec to the Pacific Coast.

My preliminary report, dated April 10th, 1872, gave an outline of the initiatory steps which had been taken for the purpose of ascertaining the engineering features of the country, so as to discover a practicable line for the railway between a point near Lake Nipissing, in the Valley of the Ottawa, and the Pacific Coast. It also furnished a summary of the information acquired up to that time.

Since the date of the above report, the work of exploration has been continued, and, from time to time, I have had the honour of laying before the Government memoranda of the surveying operations in different sections of the country, explaining the objects aimed at and the progress made.

By the end of last year a vast amount of work had been accomplished, and exact data acquired. I have, however, to report, with much regret, that on the 16th instant a fire broke out in the building occupied as offices in this city, by which the greater part of the plans, field notes and records of the surveys were completely destroyed.

In consequence of this serious disaster, much inconvenience and difficulty will be experienced in connection with the work in hand. General results are, however, known; and it will be one of the objects of this report, while the subject is fresh in the memory, with the help of such fragments of plans and documents as have escaped destruction, to place the whole on record, as fully and accurately as possible.

It is important in the first place to form a clear conception of the extent and general physical features of the whole country embraced within the limits of the exploration.

THE COUNTRY TO BE TRAVERSED.

The undertaking, proposed, is the construction of a railway to connect the sea-board of British Columbia with the existing railway system in the Provinces of Ontario and Quebec, by the most eligible line that can be found within Canadian territory.

The sea-board of British Columbia extends from the straits of San Juan de Fuca to Alaska. These points are distant, on an air line, some five hundred and fifty miles, but the coast is deeply indented by great arms of the sea, at many intermediate places, so that the actual coast line is very irregular and will probably measure several thousand miles.

The existing railway system of the older Provinces does not extend any great distance northerly or north-westerly from Lake Ontario and the River St. Lawrence; its limit may be defined by drawing a line from the south-easterly angle of the Georgian Bay, Lake Huron, across to a point on the Ottawa River, not far above the city of Ottawa.

The exploration may, therefore, be assumed to extend from the line last referred to, near the Capital of the Dominion, to that portion of the Pacific Coast lying between Alaska and the Straits of San Juan de Fuca.

A glance at a map of North America will show that the field of enquiry extends from 76° west longitude on the eastern side, to 130° west longitude on the western side, while it is bounded on the south by the 45th parallel of latitude, and on the north by the 55th parallel.

Its extreme limits thus embrace fifty-four degrees of longitude, and ten degrees of latitude, and, reduced to miles, the territory under examination will be found to cover fully twenty-seven hundred miles in length, by a breadth ranging from three to five hundred miles.

This extensive territory, with an area of one million square miles, drains into three oceans; the Atlantic to the east, the Arctic to the north, and the Pacific to the west.

We are accustomed to regard the Great American Lakes, and the St. Lawrence, which they feed, as natural features of great magnitude in one of the important hydrographic basins of the continent. It is not a little astonishing, therefore, to find that the basin of the St. Lawrence occupies such a limited portion of the vast area under consideration. While about one-fifth of the whole area drains, through several channels, into the Pacific, and seventy per cent. of the whole drains towards the north, the St. Lawrence basin only occupies about one-tenth of the whole territory.

The counterpart of this territory in the old world, with respect to geographical position, extends from the French coast across Belgium, Holland, Germany, Prussia and Russia, to the Ural Mountains in Asia, and embraces a very large portion of all these countries.

Having arrived at a proper conception of the extent of the territory under consideration, it is important to describe in a few brief paragraphs its prominent physical characteristics.

The leading botanical, in conjunction with the geological and topographical, features of the country divide it naturally into three great regions. The Eastern is densely wooded; the Western is wooded and mountainous; the Central is a vast lowland plain, for the most part prairie.

These three divisions may be referred to separately, and it will be convenient to describe first the Western Region.

THE WESTERN OR MOUNTAIN REGION.

The western portion of the country embraces the several mountain ranges and the elevated plateau which occur between the Pacific Coast and the comparatively low and level plains, that are watered by the Saskatchewan and some of the tributaries of the Mackenzie. In a northerly and southerly direction, it extends from Washington Territory in the United States to the latitude of Peace River.

This is part of the great elevated mountain zone of North America, which commences in the Cordilleras and elevated plateaus of Mexico, and extends nearly to the Arctic Ocean, branching off, in the Alaskan and Yukon Mountain ranges, towards Behring Straits. This extensive, complex, and elevated region is known as the Rocky Mountain Zone.

That portion of the Rocky Mountain Zone, embraced in the district under consideration, consists of two perfectly distinct chains of mountains, each with many spurs or branches, and several separate subsidiary ranges.

The two prominent and important mountain chains referred to, are the "Coast" or "Cascade," and the "Rocky Mountains" proper. The first is an Alpine region, more than a hundred miles in breadth; it is a continuation of the Sierra Nevadas of California, and extends along the entire sea-board of British Columbia.

The Cascade Chain rises abruptly from the sea level, presenting from the water an extremely bold and defiant aspect. The average height of the many serrated summits will probably range from 5,000 to 8,000 feet above sea level, and some of its central crests and loftiest peaks rival in elevation the main Rocky Mountain chain.

The main chain of the Rocky Mountain Zone observes a general parallelism with the Pacific Coast, and, in British Columbia, is from 300 to 400 miles distant from it. These mountains rise like a colossal wall above the continental plain on its eastern side. Their flanks are, however, deeply gashed, and great counterfort-like spurs jut out, between which the rivers of the plains take their rise.

Immediately on the western flank of the main Rocky Mountain Chain, are found high mountain masses in independent groups, and known by local names, such as "Cariboo," "Selkirk," and "Gold" ranges. They are only separated by deep chasms or narrow valleys from each other and from the main chain; indeed, they may be considered as part of it. Including these subsidiary mountain groups, the breadth of the main chain, which varies greatly, will probably average from a hundred to two hundred miles. Much of this great mountain barrier rises over 8,000 feet above sea level. The loftiest central peaks enter the region of perpetual snow, and some of them have been estimated to reach an elevation of 15,000 feet above the ocean.

There are several openings or "passes" through the Rocky Mountain Chain; some of these passes are from 6,000 to 7,000 feet above sea level. The lowest is less than 2,000 feet.

The Rocky Mountain Chain undoubtedly determines the water shed of the Continent. While the water shed is for the most part coincident with the central crest of the main range, its continuity is occasionally interrupted by transverse openings, affording, as will hereafter be seen, comparatively easy passages from one side of the mountains to the other. The most remarkable of these interruptions presents itself in about latitude 56°, where the Peace River finds a passage from the Western to the Eastern side of the main Rocky Mountain Chain and thus throws the water shed of the Continent, in this latitude, westerly across British Columbia towards the Cascade Mountains.

Between the Cascade and Rocky Mountain Chains there extends an elevated plateau, averaging from a little under 3000 to fully 4000 feet above sea level. This plateau is grooved out by deep river channels, broken by rocky ridges and inferior mountain masses. It has many lakes, occupying deep depressions in its surface, and is intersected in many directions by numerous broad, sheltered, undulating valleys.

The surface of this plateau in some quarters is thickly, at others scantily timbered, and in some districts open prairies present themselves.

This brief sketch of the physical character of the western and mountainous division of the country would be incomplete without some reference to the characteristic features of the Pacific Coast, at some point on which, between the Straits of San Juan de Fuca and Alaska, the proposed Railway must terminate.

The extreme westerly extension of the Dominion of Canada embraces two or three large islands, laved by the waters of the Pacific Ocean. The climate of these islands is comparatively temperate, and in this respect they are not widely dissimilar to the British Isles. They possess in profusion the minerals, coal and iron, which have added so enormously to the wealth of the Mother Country.

Vancouver Island is the most southerly and the largest of these islands. Its extreme length is about 280 miles; it extends northerly and westerly from the Straits of San Juan de Fuca in a parallel direction to the mainland. One hundred and thirty miles northerly and slightly westerly from Vancouver Island, the Queen Charlotte Islands begin, a group of three islands, separated by narrow channels and extending along the shore nearly 200 miles.

These islands have distinct mountain ranges of their own, with central peaks rising up from 6,000 to 7,000 feet above the sea*, or double the height of Snowdon, in Wales, Curran Tual, in Ireland, or Crossfell, in the north of England, and more than one-third higher than Ben Nevis, the culminating point of the United Kingdom. The exposed coasts of these islands are characterized by bold rocky headlands, between which deep, narrow, sheltered inlets pierce to the heart of the mountains. From the open sea the mountains present a lofty serrated outline.

These outlying islands, Vancouver and the Queen Charlotte group, stand like sentinels in the Pacific. The one guards the southern, and the other the northern portion of the seaboard of the mainland of British Columbia.

Between Alaska and Washington territory, along the Pacific shore of the mainland, there exists, within the line of the larger islands last referred to, and separated from them by channels and straits of various widths, an intricate archipelago of smaller islands. Between the innumerable smaller islands there are deep, in many places intricate passages, leading to long, rock-bound, deep-water inlets, or fiords, running far into the Cascade Mountains. On the five hundred miles of coast line there is a very large number of these remarkable arms of the sea. They are of great depth, at places reported fathomless. Many of them pierce the mountains to such an extent that the largest iron clads afloat could steam from the coast line, in some cases, eighty miles into the very heart of the Cascade Chain.

---

*Height of Victoria Peak above the sea level, 7,484 feet.
" Mount Albert Edward " 6,963 "
" Alexandra Peak " 6,394 "

These innumerable islands, intricate passages, winding channels and deep fiords are separated from each other by countless rocky bluffs and lofty mountain peaks: the latter, in some cases, rising sheer out of the sea and ascending a vertical mile from the water's edge to their bald summits.

From Alaska, southerly, along the coast to a point opposite the middle of Vancouver Island, these features are most marked, and for this distance they constitute a labyrinth of an intricate and complicated description. Between the southern half of Vancouver Island and the mainland, the intricacies of navigation to a large extent disappear.

The foregoing outline of the prominent characteristics of the Rocky Mountain Zone and the shores of British Columbia will give some idea of the difficulties to be overcome in extending the railway system of Canada to the Pacific Coast. It will be seen that two important problems are presented. Primarily, it is necessary to discover the best way of piercing the mountain chains, but it is scarcely less important that the terminating point on the sea board should be easily reached by the largest class of vessels that, now or hereafter, may navigate the Pacific Ocean.

THE CENTRAL OR PRAIRIE REGION.

Between the Rocky Mountain Zone, on the Pacific side, and the Appalachian Zone, on the Atlantic side of North America, a vast continental plain is spread out This great lowland level stretches from the Gulf of Mexico, at the south, to the Hudson Bay and Arctic Ocean, at the north.

The vast area, alluded to, occupies the whole of the continent of North America between the eastern and western mountain systems. It is divided by its river systems into two great drainage basins, the one discharging northerly to sub-arctic waters, the other flowing southerly to a tropical sea.

The northerly and southerly drainage basins, into which the vast central plain of the continent is divided, come in contact, about midway between the Arctic Ocean and the Gulf of Mexico. The line of contact lies between the sources of the Mississippi and its tributary, the Missouri, on the one hand, and the sources of the Red River, the Assiniboine, and the Saskatchewan, on the other. This line, the water-shed between the northern and southern basins, is not perfectly straight and regular, but its general direction is easterly and westerly, and, except in the longitude of Red River, does not extend far to the north or to the south of the international boundary line.*

It will thus be seen that, assuming the water-shed to be approximatetly coincident with the 49th parallel, the great continental plain of North America is divided, artificially as well as naturally, through the centre. It is divided artificially into two adjacent countries under distinct governments, and naturally into two vast drainage basins which discharge their waters in opposite directions.

---

*A line drawn from the extreme westerly end of Lake Superior to a point where the 49th parallel crosses the main Rocky Mountain chain, would more closely approximate the dividing line between the southern and northern drainage basins.

The section of the country now more particularly under consideration, and which, in the beginning of this report, is designated the Prairie or Central Region, is wholly in the northern basin.

To the east of the prairie district, and on the 49th parallel of latitude, is the Lake of the Woods. If a line be drawn from that lake, in a nearly straight north-westerly course, it will strike the general line of the Mackenzie River, between latitudes 64° and 65°, and will pass through or near a remarkable series of lakes, rivalling in size Lakes Erie and Ontario. Of these lakes may be mentioned, in their order of succession, Lake Winnipeg, with its companion lakes, Manitoba and Winnipegosis; following, we find Deer Lake, Lake Wollaston, Lake Athabaska, Great Slave Lake, and, still further on in the same general course, Great Bear Lake.

These great excavations or depressions in the surface appear to occur on the separating line between a broad band of Laurentian or Metamorphic rocks, and more recent and softer formations. If we take this line as the base of a triangle, with one side extending from the Lake of the Woods westerly, along the United States boundary to the base of the Rocky Mountains, and the other side extending from the latter place northerly along the flank of the mountains to the Mackenzie River, a description of the leading physical features of the central country will be rendered extremely simple.

The triangle will be nearly isosceles, with sides of from 900 to 1,000 miles each, and its base will measure in length about 1,500 miles.

This vast triangle, containing about 300,000,000 acres, may be described generally as a great plane, sloping gently downwards from its apex to its base. Its apex at the foot of the Rocky Mountain chain, between the sources of the Missouri and the South Saskatchewan, is estimated to be about 4,000 feet above sea level, while its base, lying along the series of lake expansions from Lake of the Woods to Great Slave Lake, will not, it is believed, average a higher elevation than 900 or 1,000 feet above the sea.

The river systems, which carry off the water-flow of this long sloping plane, are the Assiniboine, the Saskatchewan, the Athabaska, and the Peace. The first two unite their waters in Lake Winnipeg before finally passing out through the Nelson River to Hudson Bay. The last two are tributaries of the Mackenzie, and, through the channel of that river, ultimately reach the Arctic Ocean. Between the Saskatchewan and the Athabaska the River Churchill takes its rise, and flows independently in a generally north-eastern course, falling ultimately into Hudson Bay.

All the rivers of this division of the country flow for a great part of their length in deeply eroded channels, frequently of considerable width, and, as the materials underlying the plains are for the most part drift or soft rock formation, the channels which have been furrowed out are not much obstructed by falls or dangerous rapids, but generally present, from the base of the mountains throughout the greater part of their course, a uniform descent.

Although the triangular-shaped territory referred to may be viewed, in a general description, as a great plane, sloping from its apex downwards in a north-easterly direction to its base, the inclination is not perfectly uniform and unbroken. Several terraces and well defined escarpments stretch across the country at wide intervals. Much of the surface is gently rolling, and distinct hills and eminences, some of them 500 to 800 feet above the surrounding level, are occasionally met with.

The central division of the country may be described as prairie, although the whole triangular area referred to is not strictly so.

The prairie land passes into woodland in various localities to the north of the Saskatchewan, to re-appear in higher latitudes. On Peace River there are extensive prairies with extremely rich soil. In other localities, there is an agreeable mixture of woodland and prairie, and this character of country appears to prevail as far as Hay River, 400 miles to the north of the River Saskatchewan.

Although the prairie region is of vast extent, it is not all fertile. A very large area adjoining the boundary of the United States, midway between Manitoba and the Rocky Mountain Zone, is arid and unfavourable for agriculture. In other quarters a great breadth of rich pasture and cultivable land exists.

THE EASTERN OR WOODLAND REGION.

Immediately to the east of the Province of Manitoba, begins the woodland region. It extends, without much material change in its character, from the prairie region along the north side of Lake Superior and Huron to the settled and cleared portion of Ontario and Quebec, lying on the northerly banks of the St. Lawrence.

Compared with the country on the Pacific Coast, no part of this region can be considered mountainous. Along the shores of Lakes Superior and Huron a considerable extent of rough and broken elevated ground is found, but the maximum elevation attained in the highest portion of this woodland region will not exceed 2,000 feet above sea level, The band of rocky hills which runs along Lake Superior is variable in width, ranging from forty to seventy miles, and its eastern extension assumes, on the north side of Lake Huron, a width of about fifty miles.

Behind the rocky elevated range referred to, the surface is found to be comparatively flat.

Between the Province of Manitoba and Lake Superior, the drainage of the country is mainly westward, passing into Lake Winnipeg. The water shed between the two Lakes is quite close to Lake Superior, and maintains a nearly uniform elevation of from 1400 to 1500 feet, while Lake Superior is 600 feet, and Lake Winnipeg 710 feet, above the sea. The descent from the water shed westward is very gradual, and the country for the whole distance is remarkable for the innumerable streams and lakes with which it is intersected. These consist of long, winding sheets of water, separated by rocky ridges; and so numerous are they, that an Indian in his canoe can travel in almost any required direction by making an occasional portage.

Lake Nepigon lies directly north of Lake Superior and discharges into it by the River Nepigon. The descent to the latter lake is 252 feet.

Lake Nepigon is the most northerly reservoir of the St. Lawrence basin, the brim of which is here extended 120 miles north of Lake Superior. The outline of the water-shed is, however, so irregular, that, a few miles to the east of Lake Nepigon, the brim of the basin curves round until it reaches a point within 20 miles of Lake Superior. North of this point the waters flow towards Hudson Bay.

Although the general aspect of the country east of Lake Nepigon, as seen from Lakes Superior and Huron, is precipitous and rugged, to the rear of this wild and rocky frontier the surface descends northerly in easy slopes. So much is this found to be the case, that, in passing from Lake Nipissing to Lake Nepigon, through the interior of the country, the ascent to the summit level will actually be less than that which is experienced in passing from Toronto across the peninsula of Western Ontario, by either the Great Western, the Grand Trunk, the Grey and Bruce, or Northern Railways.

The drainage of the flat country referred to, as existing between the Nepigon Basin and the Ottawa Valley, flows northerly by the Rivers Albany and Moose to James Bay, while the drainage of the rugged, elevated belt along Lakes Superior and Huron passes into the basin of the St. Lawrence.

The agricultural resources of this extensive region of country are not promising. But the timber which covers the surface will every year become more and more valuable, and its geological structure affords indications of mineral wealth.

THE SURVEY.

Having thus presented a rough outline of the salient physical characteristics of the three great regions, into which the vast territory under consideration is naturally divided, I will turn to the operations carried on in connection with the Survey.

It early became apparent that the chief obstacles to be overcome would be found to exist in the Mountain Region to the west, and the Woodland Region to the east. The Prairie Region in the centre being open, easily accessible for examination and, moreover, simple in all its natural features, was not expected to be fruitful of any engineering difficulties of any kind. It would only be necessary to exercise care and judgment in locating the route for the Railway, so as to secure the least expensive bridging over the wide and deep troughs, which the rivers of the plains have furrowed out.

In the Woodland Region, nearly all our knowledge of the country was confined to the canoe routes travelled by the officers and servants of the Hudson Bay Company. There were hundreds of miles which, as far as known, had never been penetrated by any civilized man, and the aspect of the region exposed to view on Lakes Superior and Huron was far from encouraging.

In the Mountain Region some information had been gained, but the most authentic and reliable, contained in the reports presented to the Imperial Government by Capt. Palliser, called in question the possibility of constructing a Railway to the Pacific Coast, within the limits of the Dominion.

All information went to show that the difficulties to be overcome, both in the Woodland and Mountain Regions, are of a formidable character.

On being called upon to take in charge the work of exploration, the Government deemed it best to leave me entirely untramelled by any specific instructions. I was simply informed and directed, that no effort should be spared to discover, with the least possible delay, a practicable route for the Railway, in order that the terms of union with British Columbia might be carried out.

At the commencement of the survey the following leading principles were laid down:—

First. That every effort should be directed to the discovery of a line through the Woodland Region, which would prove the shortest and best possible between the existing railway system in the two elder Provinces and the Province of Manitoba.

Second. That the above line should touch, or by a branch connect with, Lake Superior, and constitute, as nearly as possible, the shortest and cheapest outlet for transport of natural products from the Prairie Region to the navigable waters of the St. Lawrence.

Third. That the greatest possible energy should be brought to bear on the work of exploration in the Western Region, in order to discover, with as little delay as possible, a practicable line for the Railway through the Rocky Mountain Zone; a line which would prove the shortest and least expensive, which would best subserve the interests of the country, and lead to the most eligible harbour on the Pacific Coast.

Fourth. That the route for the Railway through the Prairie Region, while connecting with the lines in the Eastern and Western sections, so as to reduce the distances between the Atlantic and Pacific Oceans to a minimum, should be projected, to avoid the most formidable river crossings, and approach the rich deposits of coal and iron, at the same time to be conveniently near the large tracts of land available for settlement.

My Report, presented to Parliament early in 1872, gives an outline of the course taken by me in conducting the examination of the country, in accordance with the above principles. It describes the general organization of the staff, the work of each surveying party, the progress made during the first year, and furnishes detailed reports of results obtained in the Mountain, Prairie and Woodland Regions.

EXPEDITION ACROSS THE CONTINENT.

In order to acquire a correct knowledge respecting the physical characteristics of the whole Territory, and obtain such information concerning its engineering features as only a personal examination can furnish, I considered it necessary that I should undertake a personal reconnaissance of the several regions proposed to be traversed by the Railway.

Accordingly, early in July 1872, I started with a small exploratory expedition to cross the continent.

We visited Nepigon on Lake Superior, passed from Thunder Bay by the Dawson route to Lake of the Woods and Manitoba. On the 31st July, we reached Fort Garry, and left for the west on the 2nd of August, visiting Forts Ellice, Carlton, Pitt, and Victoria, *en route*. We reached Fort Edmonton on the morning of the 27th August, and left that place for the Mountains on the following day. After a somewhat fatiguing journey through interminable windfalls and other hindrances, we entered the first range of Mountains on the 11th September, and on the 15th reached the Yellow Head Pass, and camped near the Continental Water Shed.

Pursuing our journey, we followed the River Fraser from its Yellow Head source to Tete Jaune Cache, crossed over to the Canoe River, the Albreda, and thence followed the North Thompson River to Kamloops, at which place we arrived on the evening of September 28th. From Kamloops we travelled to Lytton, Yale, and New Westminster, examined Burrard Inlet, Bute Inlet, Barclay Sound, Seymour Narrows, Dent, and Arran Rapids, visited intermediate points, and, on the 11th October, finally arrived at Victoria in Vancouver Island, thus completing a reconnaissance, which altogether extended over 5,300 miles. Some notes and an Itinerary of the journey will be found in Appendix A.

During this journey I visited all the surveying parties within reach, ascertained what progress they had made, and gave such further directions as circumstances required.

Incidentally to the main objects of this extended exploratory tour, a great deal of general information respecting the country was obtained. This information was considered sufficiently interesting and important to be given to the public, in a popular and more attractive form.* From the publication of this volume it is not necessary to lengthen this report by alluding farther to the expedition, beyond submitting one or two observations on a matter which forcibly attracted my attention.

In travelling over the Prairie Region with my party, we occasionally experienced some difficulty in procuring water for ourselves and horses, and, not unfrequently, the water when found was not of good quality. On the route of our journey, we found that all the running streams are fresh water, but there are long stretches without streams; and, although ponds and lakelets occasionally are met with, many of them are saline or brackish. The question of water supply is undoubtedly all-important. Without good wholesome water successful dairy farming, and the general settlement of the rich prairie land, cannot be expected. Feeling the importance of this matter, I considered it my duty to draw the attention of the Government to it as soon as I had an opportunity, and I recommended that a thorough examination should be made without delay, and that test borings or artesian wells should be sunk at intervals, so as to determine the water bearing qualities of districts where the surface is devoid of a proper supply.

The Government authorized such an investigation. The matter was placed under the supervision and direction of Mr. Selwyn, of the Geological Survey, and that gentleman has commenced boring operations.

If, by this means, all conjecture be set at rest, and the supply of water be assured, the attractions of the country will be confirmed.

In addition to making borings in connection with the question of water supply, it is proposed to adopt this means of tracing the mineral deposits, which crop out on the banks of the Saskatchewan and other rivers west and south of Fort Edmonton. It is not improbable that, by this means, coal will be discovered in localities favour able for settlement, where, owing to the surface-drift, none is now exposed, and which are at present without a sufficient supply of fuel.

While on this subject, it may be remarked that the importance of a thorough geological examination of the country, with as little delay as possible, can scarcely be over-rated. Captain Palliser reported the existence of large deposits of iron ore in several quarters between the two Saskatchewans. The discovery of this ore in conjunction with coal at some one or more points, which could conveniently be reached by the railway without taking it much out of the direct course, would render the manufacture of rails near the middle of the line possible, and thus obviate the immense cost of a long land transportation. Moreover, the establishment of local manufacturing industries would be assured.

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* OCEAN TO OCEAN.—A diary kept during a journey from the Atlantic to the Pacific, with the Expedition of the Engineer-in-Chief of the Canadian Pacific and Intercolonial Railways, by the Rev. George M. Grant, Secretary to the Expedition.

BRANCH EXPEDITION, VIA PEACE RIVER.

My attention having been particularly drawn by Mr. Malcolm McLeod, of Aylmer,* to a possible easy passage across the Rocky Mountains by the Valley of Peace River, I determined, in the event of not being able to extend my personal reconnaissance to that district, to send thither some of my assistants when I reached Edmonton. Accordingly at that place I selected Mr. Charles Horetzky and Mr. John Macoun, Botanist, for this duty, and before parting with them at Fort Edmonson, on the 27th August, 1872, furnished them with such written and verbal instructions as I deemed necessary.

These two gentlemen travelled in company to Fort Assiniboine, on the Athabasca River; thence to Lesser Slave Lake and Fort Dunvegan—passed through the Rocky Mountains by the Valley of Peace River, ascended the south-west or Parsnip Branch to McLeod Lake, and thence crossed over to Fort St. James, on Stewart's Lake. At Stewart's Lake they parted company. Mr. Horetzky pursued a course which led him by Babine Lake to the Forks of the River Skeena, and thence to Fort Simpson, on the Pacific Coast. Mr. Macoun travelled southerly from Stewart's Lake to the River Fraser, and followed the valley of that river to the Strait of Georgia.

The reports of these gentlemen, which are appended, will be read with great interest. They both bear testimony to the remarkable opening through the main Rocky Mountain Chain, which forms the channel of Peace River, and confirm all or nearly all that had been previously made known. They speak in glowing terms respecting the beauty of the country, the fertility of the soil, and the salubrity of the climate over wide areas on the eastern side of the Mountain Zone. (Appendices B and C.)

Mr. Macoun's botanical account of the country is of special value. His report is divided into two sections. The first embraces the results of his researches between Lake Superior and the North Saskatchewan, and the second contains his observations on the subjects which came under his notice on the journey from Fort Edmonton, *via* Peace River, to British Columbia. He furnishes lists of plants that he collected, and shows the relation which the flora of the regions that he visited bears to that of Ontario and Quebec, and by analogy arrives at conclusions with respect to the agricultural capabilities of the country.

THE WORK OF EXPLORATION IN DETAIL.

At the beginning of the survey, it became necessary to organize the staff on a scale commensurate with the magnitude of the undertaking, and it appeared ad visable to adopt a comprehensive and uniform system for all field operations, so far as it was possible. For this purpose general instructions were prepared for the guidance of each individual member of the staff in his special duties. In order to give full information respecting this particular branch of the organization, these instructions are appended. (Appendix D.)

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*Mr. McLeod, a son of an early Hudson Bay Officer Chief Trader, John McLeod, senior, spent several years of his youth with his father in British Columbia, and of late years has taken a lively interest in opening up the North West. He is the editor of "PEACE RIVER—a canoe voyage from Hudson's Bay to the Pacific by the late Sir George Simpson, &c., in 1828," published by Durie & Son, Ottawa, 1872.

In a field of enquiry so extensive and, in some respects, so uninviting, it has been a matter of serious difficulty to find a sufficient number of thoroughly competent and reliable assistants to carry on the exploration satisfactorily. I was, however, fortunate in securing the services of some of the best men that were available, and I shall now refer to their work, since the date of my last report.

In the spring of 1872, Mr. Marcus Smith was appointed, on my recommendation, to act as my Chief Resident Assistant in British Columbia, and he was specially charged with the surveys deemed necessary between Victoria, Vancouver Island, Bute Inlet, and the Fraser River. At the same time he was directed to assume general charge, in my absence, of all other surveys going on in the Mountain Region.

After the appointment of Mr. Smith, all correspondence relating to the survey in British Columbia was carried on with him; and through him my instructions to others were conveyed and all reports received.

The report of Mr. Marcus Smith for the year 1872 is given at length (Appendix E.) It will be found to give a detailed account of everything of importance effected during that year in British Columbia, with a narrative of his own journeyings between Bute Inlet, the Homathco Pass and the Chilcotin Plains to Carriboo, to the North Thompson River, and to the Quesnelle Lakes; it also gives the particulars of his reconnaissance along the easterly coast of Vancouver Island for a line of railway between Seymour Narrows and Esquimault. In Mr. Smith's detailed report will be found a carefully prepared description of the physical features of British Columbia, and all particulars regarding the engineering character of the lines surveyed up to the end of 1872.

In the Woodland Region east of Manitoba, the tedious work of exploration has been continued by a number of parties, under the supervision of Mr. James H. Rowan.

The dense forest which covers the face of the country everywhere, together with the entire absence of roads or trails, has rendered this work peculiarly laborious and to some extent hazardous. I refer to Mr. Rowan's report for 1872, for detailed information respecting the parties and the work done during that year, in the region referred to. (Appendix F.)

Before the appointment of Mr. Smith to the general charge of all the surveys in the Mountain Region in the West, I had instructed Mr. Walter Moberly to proceed to the heart of the Main Rocky Mountain chain and make an instrumental survey from Tête Jaune Cache through the Yellow Head Pass and Jasper Valley.

Mr. Moberly was in the Mountains during the summer of 1872 and the following winter. In January, 1873, he forwarded me a report from his quarters in the Jaspar Valley. As this report gives an account of some of the difficulties he had to contend with and the work done by the parties under his charge, and as it contains notes on various matters of interest which came under his view, I beg leave to submit it (Appendix G).

During the year 1873, surveys were continued in those portions of the country where difficulties of a special nature had been previously met. In British Columbia an effort was made to find a route to the Pacific Coast, which would prove less objectionable than either of the lines surveyed by the Homathco, the Fraser, or the Coquihalla Rivers.

In addition to this work, surveys were made from the base of the Rocky Mountains, easterly, towards Edmonton, on the North Saskatchewan. A re-survey was made of the line from the Yellow Head Pass, westerly, to Tête Jaune Cache, and the low water-shed between the River Fraser and River Canoe; and thence the exploration was extended in the direction of Quesnelle Lake.

In the Eastern Region, explorations of an exhaustive character were instituted to ascertain if it would be possible to carry the main line of railway past the south of Lake Nepigon, instead of to the north of it, in order to reduce the Lake Superior branch to a moderate length. It was known that theground was unfavourable, but it was felt that a very considerable saving in the total mileage of railway to be constructed would, in all probability, be effected; more than sufficient, possibly, to compensate for any heavy expenditure which would be involved in constructing the line through a portion of the rugged ground which extends immediately along the shores of Lake Superior.

Besides this survey work, explorations were made northerly, from the western as well as the eastern ends of Lake Nipissing, in order to obtain a knowledge of the country in the interior, and such additional information of a reliable character as would be useful in projecting the most direct and most favorable line for the railway, between the latitude of Lake Nipissing and the northern bend of Lake Superior.

Accompanying this, will be found Reports, giving an account of all matters of importance connected with the surveys, made during the past season (Appendices H. and I.)

These detailed Reports so fully describe the progress made, the difficulties met, and the work done in the year 1873, that it is not necessary for me to enter at length on this branch of the subject; I shall, therefore, at once proceed to consider the general results of the survey to this date, and submit an account of that which has been accomplished.

GENERAL RESULTS OF THE SURVEY.

I beg leave first to refer to what has been done, and is found to be possible, in the region of country bordering on the Pacific Ocean.

RESULTS IN THE MOUNTAIN REGION.

It has been found that of all the "Passes" through the main Rocky Mountain chain, between the International boundary line and the 53rd parallel of latitude, the Yellow Head Pass is the most favourable, and that the approaches to it, from both sides of the Mountain Range, are of such a character as to render the construction of a railway, across the great continental water-shed, a far less difficult matter than was previously imagined.

North of the 53rd parallel, information respecting other passes, some of them even lower than the Yellow Head, has been obtained.

Smoky River Pass, the first in order as we proceed northerly, is especially referred to in a report by Mr. Smith, (Appendix K.)

Pine River Pass succeeds. This pass, as well as Peace River Pass, still further north, are referred to in the reports of Messrs. Horetzky and Macoun, the gentlemen whom I specially detailed, from my own expedition, to collect information respecting the northerly portion of the country. (Appendices B and C).

The information, acquired respecting these three passes, affords reason to believe that the railway might be carried through any one of them. But the question of crossing the main Chain of the Rocky Mountains is not the only one to be considered, nor is it now the principal consideration, as this portion of the problem has met with a satisfactory solution.

The most serious difficulties are found to lie in piercing the Cascade Chain, and in descending from the level of the elevated plateau, in the heart of British Columbia, to the level of the ocean.

This great plateau actually stands at a higher general altitude than Yellow Head Pass. If the Rocky Mountains were crossed at some lower point, it would not obviate the necessity of ascending to the level of the plateau, or remove the difficulties which are undoubtedly met in making the descent by every known opening through the Cascade Chain to the ocean level.

For many reasons it is desirable to reach the Pacific Coast, at some eligible harbour, south of the 53rd parallel If this can be accomplished by a favourable route from Yellow Head Pass, to take it by a pass in a more northerly latitude would only lengthen the railway, without gaining any compensating advantages. If, on the other hand, it be found impracticable to reach the sea board, south of the 53rd parallel, at any reasonable outlay, the importance of the passes known to exist, north of the Yellow Head, will be enhanced. It is doubtful, however, if the northern passes possess any positive advantage over the Yellow Head Pass, unless there be discovered, north of the 53rd parallel, a more satisfactory outlet, through the Cascade Mountains to the coast, than any yet known. Thorough explorations alone will shew if any such outlet exists.

In order to give as correct an idea as possible of the character of all the lines across the Rocky Mountain Zone, which now come under consideration, diagrams have been prepared, showing the approximate general gradients, which may be obtained on each line. In order to simplify a comparison between them, the several lines surveyed or projected have been arranged and combined so as to form seven distinct routes, between the longtitude of Edmonton and the Pacific Coast.

It might lead to some confusion, if these routes were numbered, in the order of time in which the surveys were made. I have, therefore, thought it preferable to number them consecutively from the south to the north. For the purpose of comparing distances, each route is extended to a common longtitude near Fort Edmonton on the North Saskatchewan.

Route No. 1—Begins at Burrard Inlet, near New Westminster. Follows the Lower Fraser River to Fort Hope, passes up the Coquihalla Valley, and thence by Nicola Lake to Kamloops. At Kamloops it enters the valley of the North Thompson, following which it passes over a low water shed at Lake Albreda to River Canoe, and thence crosses by Lake Cranberry to Tête Jaune Cache. From the latter point, it follows the River Fraser to one of its sources, near the Yellow Head Pass, and thence by the Caledonian and Jaspar Valleys to the eastern side of the Rocky Mountain Chain, thence easterly by the McLeod and Pembina Rivers to the North Saskatchewan.

The great difficulties on this line are met with between Hope and Kamloops, in a distance of 128 miles. The first summit is only 33 miles distant from Hope, and its elevation above tide water is 3,513 feet, while Hope is only 127 feet. Proceeding northerly, the ground falls to 2,028 feet in 34 miles, and again rises to 2,960 feet, and finally falls to 1,170 feet near Kamloops. From Kamloops to Edmonton, a total distance of 544 miles, very favourable gradients may be had with comparatively light work. It certainly need not exceed the average of work on many of the railways in the Eastern Provinces of the Dominion.

On some portions of this line, between Hope and Kamloops, gradients would unavoidably be very steep, ranging as high as 172 feet per mile, and the work would be necessarily heavy. Several tunnels would be required, one of which, it is estimated, would be three and three-quarter miles in length. The aggregate tunnelling on this rough section would probably be over five miles.

For a diagram of the general gradients on this route I refer to Sheet No. 1.

Route No. 2—Begins at Burrard Inlet, and, like Route No. 1, follows the River Fraser to Hope, but instead of crossing a depression in the Cascade Chain by the Coquihalla Valley, it continues to ascend the River Fraser to Lytton. At the latter point it passes into the Valley of the River Thompson, and follows the course of that river to Kamloops. From Kamloops to Yellow Head Pass and Edmonton, Routes Nos. 1 and 2 are common, and on this section, that which is said with respect to the one applies with equal force to the other. Between Hope and Kamloops the distance is 165 miles. Although no high summit is to be passed over, this section is far from favourable. Long stretches along the canyons of the Fraser and the Lower Thompson, occupying about half the whole distance, are excessively rough. On these sections formidable difficulties present themselves; the work would be enormously heavy, and the cost proportionate.

Had the Rivers Lower Thompson and Fraser flowed through wide valleys to the sea, this route would unquestionably have been the natural and proper line for the railway. The gradients from the summit of the Rocky Mountains at Yellow Head Pass would have been very light, and would have proved generally uniform and continuous. The passage, however, for these united rivers, through the Cascade Chain, is so extremely contracted that it will be a matter of great difficulty to find sufficient space for a railway through the remarkably narrow and rock-bound gorge cleft through the mountains. Sheet No. 2 will show the general gradients on this route.

Route No. 3—Begins at Howe Sound, crosses the Cascade Mountains by a series of openings to the River Fraser at Lillooet, and thence passes over the plateau in the centre of British Columbia by the Marble Canyon and Bonaparte Valley to the North Thompson, near the mouth of the Clearwater River; from this point it ascends the Thompson and runs on the same common ground as Routes 1 and 2 to Yellow Head Pass and Edmonton.

From Howe Sound to the North Thompson, by this route, the distance is 284 miles; within this distance the line passes over four main summits, ranging in elevation from 1,610 to 3,847 feet above the sea, and between these summits the ground falls twice to 700 feet and once to 1,847 feet. These great changes in level are suggestive of unusually heavy ascending and descending gradients, as well as equally heavy works of construction. From the point where this route intersects the valley of the River Thompson, it takes the same course to Edmonton as Routes Nos. 1 and 2. The general gradients on this route will be seen on Sheet No. 3.

Route No. 4—Commences at Waddington Harbour, on Bute Inlet, and ascends by the valley of the Homathco through the Cascade Chain of Mountains to Lake Tatla, thence it passes over the Chilcotin plains to the River Fraser; it crosses the Fraser about 16 miles below Soda Creek, and continuing easterly by Lac la Hache and Lake Canin, reaches the River Thompson valley, near the mouth of River Clearwater

From the latter point it pursues the same course to Edmonton as Routes Nos. 1, 2 and 3. From Bute Inlet to the North Thompson valley, by this route, the distance is 378 miles. On this distance three summits are passed over. *First*, at 87 miles from Waddington Harbour, the water-shed between the Homathco and the Chilcotin Rivers, at an elevation of 3,117 feet above the sea. *Second*, on the Chilcotin plain, 53 miles west of the River Fraser, the height is 3,700 feet. *Third*, about midway between the Rivers Fraser and Thompson, the elevation is 3,104 feet. At the River Thompson the height is about 1,400 feet, and the crossing of the River Fraser is at the same level. There are long stretches on this line where the work would be light, but in some sections it would be very heavy. Ascending the Homathco for a distance of 15 miles through the great canyon, a continuous uniform gradient of 110 feet per mile would be required, involving works of an excessively heavy character, embracing cuttings in granite, and a great number of short tunnels, amounting in the aggregate to about three miles.

The greatest difficulties on this line are undoubtedly met with between tidewater and the head of the great canyon; the ascent on this section is 2,285 feet in 34 miles, of which 1,650 feet would have to be overcome in 15 miles.

The River Fraser is crossed with much less difficulty than expected; the line approaches it on grades as high as 87 feet per mile, but without much heavy work. The bridge need not exceed 800 feet in length and 30 feet above the river.

The descent from Lake Canin to the Thompson Valley is very difficult. The character of the ground renders objectionable curves and gradients necessary, and the rock excavation would be very heavy. The remaining portion of this route to Edmonton may be considered favourable. For the diagram of gradients on this route, see Sheet No. 4.

Route No. 5.—This is a projected modification of Route No. 4. The change proposed lies between the Chilcotin plain and the Thompson Valley, above Blue River, and is the result of an exploration made late last autumn, by which it is believed much of the objectionable portions of the route last referred to, may be avoided. Sheet No. 5 gives an idea of this route. The firm surface line is from actual survey, and the dotted line, between the Fraser and Thompson Valleys, shows approximately the general gradients, which the information recently acquired lead us confidently to hope may be obtained.

Should an instrumental survey result in the realization of these expectations, this route will present very decided advantages. The difficulties met with, ascending from ocean level by the great canyon of the Homathco to the level of the Central plateau of British Columbia, will, it is true, still remain, but these difficulties will practically be confined to only fifteen miles of line, and will be surmounted when the head of the canyon is reached. The head of the canyon is forty-four miles from Waddington Harbor and 2,285 feet above the sea level. This point is not far from the same level as Fort Edmonton, and, if the information received be well founded, it appears quite possible to connect these two points, 762 miles apart, by a railway, having remarkably easy undulations. On the diagram (Sheet No. 5) a level line is drawn from the head of the canyon to Edmonton. An inspection of this diagram will show that there will be an intermediate depression under this level only at one point, and there merely to the extent of 800 feet; while the highest point, the Yellow Head Pass, will not be more than 1,500 feet above it.

This route commands attention. Although a very heavy expenditure will undoubtedly be required to construct the railway for the first forty-four miles easterly from the Pacific Coast, it is thought that the average cost per mile, through the whole of the Mountain Region, with this exception, will be moderate. It will be quite possible, if present expectations be realized, to obtain a line, east of the great Canyon, for the railway, on this route, with as favourable gradients as those which obtain on the existing railways in the Eastern Provinces. In operating the Railway, ordinary rolling stock would be available throughout, except on the fifty miles section adjoining the Pacific Coast; on this section special engines would be required for the heavy gradient along the Canyons of the River Homathco.

Route No. 6.—On sheet No. 6, is shown the approximate gradients on a route projected from Bute Inlet by the Chilcotin Plains to Fort George, and thence by the valley of the Upper Fraser River to Tête Jaune Cache, where a junction is effected with the route through the Yellow Head Pass to the east.

Reliable information has been received respecting this route. In fact, the most difficult and doubtful portions of it have been surveyed instrumentally, the remaining portions are approximately shown on the diagram by a dotted line. By this route it is expected that, in crossing from Bute Inlet to Fort George, near the great bend of the Fraser, a higher elevation than the Yellow Head Pass would be attained. But from Fort George to Tête Jaune Cache the character of the Fraser Valley is reported to be such as to leave no doubt that a favourable line may be had. It has always been felt that this route would be an alternative to fall back upon, in the event of difficulties of an insuperable or very serious character presenting themselves on the route further to the south.

Should it become advisable to make a more complete examination of this route, I think the exploration should be extended, easterly across the Rocky Mountain chain, by that branch of the River Fraser designated " The North Fork." Information has been received, which leads to the belief that Smoky River Pass, through the mountains, will be found at the head of this branch which, if otherwise favourable, might shorten the distance between Fort George and Edmonton. All the information known about this pass will be found in Appendix K. It is not expected that the Smoky River Pass will prove of lower elevation, or be generally more favourable than the Yellow Head Pass. It is possible, however, although by no means certain, that the mileage from the northern great bend of the Fraser, to the easterly side of the Mountain Chain, might be shortened, and it would be well to test the matter.

Route No. 7.—All parties, who have visited the River Skeena, and acquired from personal observation any knowledge respecting its outlet and the character of the country in that district, seem to unite in an adverse opinion respecting the eligibility of the River Skeena, as a route to the seaboard.

The outlet of the Skeena is situated fully 300 miles, in a direct line, northwesterly from Bute Inlet. Between these two localities, very little is favourably known of the coast or of the country. So far as I can learn, recent examinations have been made only in one locality. In the summer of 1862, Lieut. Palmer, R. E., spent four months in exploring the country on the North Bentinck Arm, and thence by the River Bella Coola, through a gap in the Cascade Mountains, to the elevated plateau in the interior, across which he passed to the River Fraser. This gentleman made a section through the Bella Coola gap and ascertained that the ascent was very precipitous. At about 60 miles from the coast, he reached an elevation of 3,840 feet and of this height found that 2,730 feet had to be surmounted in about 16 miles. Seventy miles further, he gained the summit at an altitude of 4,360 feet, being nearly 600 feet higher than the Yellow Head Pass.

From the measurements of Lieut. Palmer and from other elevations ascertained, it is believed, with tolerable accuracy, from accessible authorities, a diagram has been compiled, showing the approximate general gradients, which it is thought may be found on route No. 7. This route after leaving the North Bentinck Arm and the Bella Coola gap, crosses the plateau to the Giscome portage, thence by Fort McLeod to Peace River, which it follows through the mountains. Very little can be said with regard to the nature or magnitude of works of construction on this route, as all the information respecting it is of a general character. Enough is known, however, to lead to the belief that, by this route, a point within less than 300 miles of the Pacific Ocean may be reached from the Eastern Provinces of the Dominion, without attaining a higher elevation than 2,000 feet above the sea. But to cross the Cascade chain to the coast, at any point between Bute Inlet and the River Skeena, it appears, from all information yet obtained, that it would be necessary to ascend a height some 600 feet greater than the elevation of the Yellow Head Pass. For the diagram of this route see Sheet No. 7.

As the question of crossing the Cascade Chain, to a suitable terminal point on the coast, is daily becoming of greater importance, and as the North Bentinck Arm is probably a fair type of all the deep arms of the sea in the same region, I have attached copies of extracts from the report of the exploration made by Lieut. Palmer (Appendix L).

It is a coincidence worthy of remark, that this route between the Pacific Ocean at the mouth of the Bella Coola, and Fort Dunvegan, on the Peace River, where it flows on the eastern side of the Rocky Mountain Chain, is, with some trifling diversions, identical with the track of Sir Alexander Mackenzie, who, in 1793, on his memorable voyage of discovery across the Continent, was the first civilized man to penetrate this country, and reach the Pacific Ocean from Canada. This intrepid traveller, after wintering about 150 miles below the place now known as Dunvegan left on the 9th May, followed up the Peace River to its source, continued westerly and arrived at the Pacific coast en the 22nd July. Returning by the same route, he arrived at the post where he had spent the previous winter on the 24th August following.

I have made some extracts from the narrative of this traveller, giving the impressions which he formed, as far as he recorded them, of the features of the country along the track which he followed from the central plateau, through the Cascade chain, to the sea coast. (Appendix M.) On comparing dates, it will be found that Sir Alexander Mackenzie reached the Pacific coast and camped at points visited and named by the first discoverer, Capt. Vancouver, only a few weeks previously.

Before referring to the results of surveys in other portions of the territory, I may state, with regard to the practicability of reaching the Pacific Coast, at other points than those referred to, that I have made every enquiry on the the subject, but I cannot learn that examinations of any consequence, other than Lieut. Palmer's, have been made, along the coast between Bute Inlet and the River Skeena, since the time of the discoveries of Vancouver and Mackenzie in 1793. Our information, therefore, is but vague, and the possibility of crossing the Cascade Mountains from the east to any one of the many other Inlets, which indent the coast, in the absence of all reliable information, can be nothing more than mere conjecture.

So little knowledge of this part of the coast has been recently acquired, that the latest admiralty chart that I have been able to procure appears, in all essential particulars, to be an exact copy of the chart made by Capt. Vancouver 80 years ago.

As Vancouver's Voyage of Discovery is a book rarely met, and as this work contains information not elsewhere recorded, I have appended some extracts from this volume in order to give some idea of the character of the coast, and to assist in forming a judgment as to the possibility of reaching it from the interior. (Appendix N). To elucidate these extracts the chart of Capt. Vancouver's discoveries on this portion of the coast is also submitted. (Sheet No. 16.)

THE RAILWAY ON VANCOUVER ISLAND.

In order to ascertain how far it may be practicable to reach Victoria, Esquimault, and other ports on Vancouver Island by a continuous line of Railway from the mainland, a survey was made from Waddington Harbour, at the head of Bute Inlet.

The survey extended along the north-westerly shore of Bute Inlet to Valdes Island, and passed over to Vancouver Island at Seymour Narrows; from this point an exploration was made along the Easterly Shore to Esquimault, and to the Harbour at the head of the Alberni Canal or Inlet.

For a distance of about 50 miles from Waddington Harbour, the only course for the line is to follow the base of the high rocky mountains which extend along Bute Inlet. On this section a great number of tunnels, varying from 100 to 3000 feet in length, through bluff rocky points, would be indispensable, and the work generally, even with unusually sharp curvature, would be very heavy.

Careful examination has established the fact that to reach Vancouver Island from the mainland the following clear span bridges would be required:

At	Arran Rapids		clear span	1100	feet.
"	Cardero Channel	—first opening	"	1350	"
"	"	—second opening	"	1140	"
"	"	—third opening	"	640	"
"	Middle Channel		"	1100	"
"	Seymour Narrows	—first opening	"	1200	"
"	"	—second opening	"	1350	"

1680

The length of the section across the group of Islands, known as Valdes Islands lying between the mainland and Vancouver Island is about 30 miles. The channels to be bridged are of great depth, with the tide flowing from four to nine knots an hour.

In crossing the Islands, heavy rock excavation and probably a few short tunnels would be required.

Taking everything into consideration, the works of construction, on these eighty miles, lying between Waddington Harbour and Vancouver Island, would be of a most formidable character.

In Mr. Smith's Report for 1872 (page 134) will be found an account of the examinations he made from Seymour Narrows, along the west coast of Vancouver Island to Esquimault. I have myself made a general reconnaisance of portions of the country and am satisfied, from what I have seen and learned, that this line would be generally favourable, with works of a moderate character.

The whole distance between Seymour Narrows and Esquimault would be about 160 miles; of this distance 25 miles, between the latter place and Cowichan, would have heavy rock excavations. From Cowichan to Nanaimo, 35 miles, the work would be somewhat lighter. The remaining 100 miles would be very favourable.

An exploration was made from the coast line to the Harbour at the Head of the Alberni Canal with satisfactory results. This examination showed that it would be quite practicable to carry the Railway to the seaboard on the west coast of Vancouver Island by this route.

Whatever point on the main land be selected for the Terminus of the Transcontinental Railway, there can be no doubt that a line along the Eastern coast of Vancouver Island will, at no distant day, form part of the Railway system of British Columbia.

Vancouver and adjacent islands of the Straits of Georgia, possess sources of wealth in coal and iron lying side by side, capable of immense development. The Eastern coast is believed to be rich in these and other natural resources for nearly its entire length. From Cowichan to Seymour Narrows, a distance of more than 130 miles, the Geological Survey has already obtained positive information, which leaves no doubt on this head. The Eastern coast of Vancouver Island, in addition to its mineral wealth, is known to possess considerable tracts of excellent agricultural land, the climate is salubrious, and, with these elements of prosperity, it cannot fail to become the centre of a large industrial population.

It is quite evident that a trunk line of Railway will soon be required from Victoria and Esquimault *via* Cowichan, Nanaimo, and Comox to Seymour Narrows, eventually perhaps as far north as Fort Rupert, near the northerly end of the Island, with branches to Alberni on Barclay Sound, Nootka Sound, and other good harbours on the western coast.

To connect this insular portion of the British Columbia Railway System with the main land, by a direct unbroken line, such as that projected across the Valdes group of Islands, will be a difficult and enormously expensive undertaking. Until the traffic be to some extent developed and the prospect justify the outlay, a steam ferry suitable for railway traffic can be easily established between Vancouver Island and the terminus, on the main shore, such as would probably for some time answer every purpose.

A Map of British Columbia, showing the various routes surveyed and projected across the Rocky Mountain Zone, and also the line explored from Esquimault to Seymour Narrows, on Vancouver Island, is submitted. (Sheet No. 8.)

RESULTS IN THE PRAIRIE REGION.

No continuous instrumental surveys have as yet been made, between the crossing of Red River in Manitoba and the termination of the surveys through the mountain region, at a point about 120 miles westerly from Fort Edmonton. The intervening prairie country has, however, been traversed in various directions, and, although the reconnaisance of this region can scarcely be considered complete, enough is known to warrant the belief that there will no great difficulty in projecting a favourable line, with comparatively light work, from Manitoba at the east, to the Yellow Head Pass at the west. It will only be necessary to bring to bear on the location of the line ordinary good judgment, to reduce to a minimum the actual cost of crossing the large rivers and the deep and wide furrows, through which many of the streams of the plains flow. It did not appear advisable to spend much time in survey work in the prairie country. I considered it more important to direct attention, in the first place, to those districts where difficulties really existed, or were considered to exist. Not only are the engineering characteristics of the prairies easily understood, but there will be ample time afforded for detailed examinations, in advance of construction. The railway will necessarily be commenced first where the country is accessible, on the eastern and western sections, and it will be some time before the central region is reached.

The foregoing remarks have reference to the Yellow Head Pass, as the objective point on the western side of the prairie region. Should future discoveries in British Columbia point to the expediency of abandoning that pass, for one more northerly, my general impression is that the country, on the eastern side of the Mountain Chain, is not unfavourable for the change. Although the information is very general and imperfect, I have no reason to apprehend that there will be anything to prevent a line of railway being constructed, at moderate cost, to any of the known passes through the mountains as far north as Peace River.

While geographical or other circumstances may necessitate the commencement of the railway at points more accessible than in the central region, it is generally admitted that great advantages would result from settlement, making some progress in the country, in advance of the railway. It fortunately happens that the lakes and rivers in the interior are so situated, in relation to much of the land fit for cultivation, that they can, with moderate outlay, be rendered available as immediate means of communication, and thus greatly facilitate settlement. Lake Winnipeg, a body of water as large as Lake Ontario, affords the means of reaching an extensive district. Lakes Manitoba and Winnipegosis may be employed in assisting the settlement of the rich lands to the west of them, as far even as the Touchwood Hills; and the River Saskatchewan could, at no very great cost in portaging, or by deepening the rapids, be rendered navigable for light draught steamers.

Mr. Selwyn, the director of the geological survey, has furnished me with some important information respecting the Saskatchewan.

That gentleman passed down the river last season, the whole way from Rocky Mountain House to Lake Winnipeg. The journey was performed between the middle of September and the 17th October, when the water was low, and thus he had an excellent opportunity of seeing all the impediments which exist. At my request Mr. Selwyn has favoured me with the result of his observations, (Appendix O).

The chief difficulty to navigation on the Saskatchewan appears to be the Grand Rapid, at the point where it falls into Lake Winnipeg. A portage railway of three miles would easily overcome that obstacle. From thence up to Edmonton, even to Rocky Mountain House, Mr. Selwyn says, the river in its present unimproved condition might be used during the early summer months, by properly constructed light draught steamers.

Next to the Grand Rapids, the Cole's Falls or Rapids, above the confluence of the two Saskatchewans, appear to constitute the most serious impediment to the navigation. These rapids are estimated by Mr. Selwyn to extend over a length of twelve miles, with a total descent of probably forty-five feet. Only two other places are spoken of as likely to give any difficulty to steamboat navigation, especially during the latter part of the season, when the water is low. They are the Crow Lake Rapid and Thobon's Rapid; both on the main Saskatchewan, the one below, the other above Cedar Lake. It is not improbable that a moderate expenditure in removing some of the large boulders, which everywhere fill the bed of the river, so as to form a channel with a uniform depth at these rapids, would render the Saskatchewan navigable above the Grand Rapids, for properly constructed steamers, during the whole summer.

The speediest and simplest way of overcoming the Grand Rapids would be by means of a cheap portage railway, or they might be avoided altogether by establishing a line of communication through the Lakes Manitoba and Winnipegosis. The latter route would undoubtedly better facilitate the settlement and development of the country, but it would cost more than the route by the Grand Rapids.

A memorandum on the surveys which have been made, in connection with the proposed route through Lakes Manitoba and Winnipegosis to Cedar Lake on the main Saskatchewan, is attached. (Appendix O.)

Plans and sections of the principal portages referred to above are submitted (Sheet No. 11).

There is one subject which probably has as important a bearing, directly and indirectly, on the route and maintenance of the railway across the prairie region, as any other. I refer to the question of fuel. For nearly a thousand miles, the timber that now exists will be sufficient to meet the demand for building and fencing purposes, and, therefore, the importance of a supply of mineral fuel, at convenient points, becomes very great, not only for consumption on the railway, but for the use of settlers. The scarcity of wood for steamboats will indeed be felt the moment steam navigation is introduced on the Saskatchewan, and it will probably be necessary to float coal down the river from the thick seams above Edmonton.

Mr. Selwyn has formed a theory, which, if confirmed by actual discoveries, will prove of incalculable benefit. His examinations convey the impression that the coal-bearing rocks pass with their associated coal seams and iron ores beneath the clays "which are observed in the vicinity of Fort Pitt and the Elbow, and it may be that boring along the river valley would reveal workable seams of coal at such a limited depth beneath the surface as would render them available, even as low down as Carleton."

This matter is so vitally important that it cannot too soon be brought to the test.

RESULTS IN THE WOODLAND REGION.

In accordance with the principles laid down at the beginning of the survey, in the spring of 1871, the first efforts were directed to the discovery of a route for the main line, which would touch Lake Superior, at such a point in its course, as would make the Prairie Region accessible from that lake, during the season of navigation.

The first efforts were not successful. The work of exploration, extending over a whole season, with a strong staff of surveyors, although undoubtedly the means of acquiring a great deal of reliable and important information, did not result in the discovery of a practicable line.

Explorations were continued during the following winter and summer, and, by the end of 1872, a practicable and favourable route for the main line was found.

The route passed round the north side of Lake Nepigon, and, in order to connect it with the navigation of Lake Superior, a branch line was rendered necessary.

Two surveys for the branch were made. The one to Thunder Bay, the other to Nepigon Bay. The estimated distance, from the main line to the former point, was about 150 miles, and to the latter point about 105 miles.

The position of the main line, north of Nepigon, involving the construction of so long a branch, was not satisfactory. Surveys were therefore renewed in the spring of 1873, in the hope of finding a more suitable location. It was felt that the saving effected by a reduction of the length of the Lake Superior branch would compensate for the extra cost involved in passing through a portion of difficult ground. It was known that the rugged district along the coast of Lake Superior could not wholly be avoided, but it was expected that exhaustive surveys would result in showing where the fewest difficulties would be encountered.

While five surveying parties, fully equipped, were engaged in this examination, the country between the valley of the Ottawa and Lakes Huron and Superior was farther explored, with the view of projecting the most direct practicable route from a point east of Nepigon to the westerly and to the easterly sides of Lake Nipissing.

During the present winter, two surveying parties have been and are still at work, west of Lake Nepigon. But the characteristic features of the district, in which they are engaged are well understood, and I do not apprehend they will meet with much impediment. Their duty is mainly to connect previous surveys by a chain of measurements in order to shorten distances. This work, as much of the ground is marshy and broken by innumerable small lakes, can best be done in the winter season.

I am now able to report that the results are satisfactory—that the surveys conducted in the Woodland Region have made favourable progress.

Assuming that the work of the two winter parties will be completed without meeting serious difficulties, I may venture to report that three practicable routes have been found.

A diagram has been prepared for the purpose of showing the general gradients on these three routes, and, as I am describing them, it will be convenient to refer to the diagram (sheet No. 9).

All three routes begin at a common point on the shore of Lake Manitoba and with the exception of No. 1, terminate at the south-east angle of Lake Nipissing. Route No. 1 terminates at Mattawa, opposite Lake Nipissing.

It may be observed that long portions of each route are common, but, in order to make a proper comparison of their respective length and general engineering features, the diagram is prepared so as to show each as a complete and distinct route, between the terminal points referred to. The distances are given with as much accuracy as can, at present, be ascertained.

Route No. 1 passes north of Lake Nepigon; its total length is 1,047 miles.

Route No. 2 passes south of Lake Nepigon and touches the navigable waters of Lake Superior, near the mouth of Nepigon River; its total length is 1,038 miles.

Route No. 3, like No. 2, passes south of Lake Nepigon and touches Lake Superior navigation on Thunder Bay; its total length is 1,102 miles.

It has already been stated that route No. 1 would require, in order to reach steamboat navigation on Lake Superior, a branch to Thunder Bay of about 150 miles; to Nepigon Bay of about 110 miles.

Route No. 2 would require a branch, of about ten miles in length, to reach a point on Nepigon Bay designated Red Rock, where steamboats now touch, but the surveys which we have made establish the fact that, by straightening and dredging out the channel between Nepigon Bay and a sheet of water known as Lake Ellen, the navigation of Lake Superior could be extended to the head of the former lake, ten miles inland. The main line by route No. 2 would touch the head of Lake Ellen and thus, by the improvements referred to a branch would not be required.

Route No. 3 touches the navigable waters of Lake Superior at Prince Arthur's Landing, on Thunder Bay and therefore requires no branch.

In estimating the distance between Lake Manitoba and Lake Superior, it should be borne in mind, that the navigation of Lake Superior can, at a trifling cost, be extended from Thunder Bay up the River Kaministiquia, to a point about eight miles above Prince Arthur's Landing. In the comparison which follows, it will be convenient to call this point Kaministiquia.

Route No. 2, in its course from the west to Lake Ellen, touches Lake Nepigon at Chief's Bay. By constructing locks between Lake Superior and Lake Nepigon, steamboat navigation could be extended to Chief's Bay. The elevation of Lake Nepigon above Lake Superior is 260 feet, and the cost of rendering these waters navigable, by means of locks, would be too heavy to be seriously entertained at the present time. But it will be possible to do so, should the period ever arrive when the traffic shall have grown sufficiently great to warrant the expense, and when it shall have become a matter of vital importance to reduce land carriage for the products of the Prairie Region, to a minimum.

According to the information obtained, the approximate distances from a common point on Lake Manitoba, 65 miles westerly from Red River, to the several places above referred to, are as follows:—

				Miles.
By Route No. 1—	To Kaministiquia	Main line	353	
		Branch	142	495
Ditto	To Prince Arthur Landing	Main line	353	
		Branch	150	503
Ditto	To Lake Ellen	Main line	395	
		Branch	95	490
Ditto	To Red Rock	Main line	395	
		Branch	105	500
Ditto	To Chief's Bay	Main line	395	
		Branch	55	450
By Route No. 2,	To Lake Ellen	Main line		481
Ditto	To Red Rock	Main line	481	
		Branch	10	491
Ditto	To Chief's Bay	Main line		440
By Route No. 3,	To Kaministiquia	Main line		463
Ditto	To Prince Arthur Landing	Main line		471

The total length of railway to complete the whole scheme between Lakes Manitoba, Superior, and Nipissing, by the three different routes is estimated as follows:—

			Miles.
Route No. 1,	the Main line	1047	
	Branch to Prince Arthur Landing	150	1197
Ditto	The Main line	1047	
	Branch to Red Rock	105	1152
Route No. 2,	the Main line	1038	
	Branch to Red Rock	10	1048
Route No. 3,	the main line		1102

It appears from the foregoing, that route No. 1 has not the advantage with respect to distance. It is the longest route between Lakes Manitoba and Superior. It is not the shortest through route, and, taking the total length of railway to be built, for main line and branches, it exceeds route No. 3 by 95 miles, and route No. 2 by 104 miles. It is now, therefore, satisfactorily established that there will be no advantage gained by carrying the main line to the north of Lake Nepigon, and the choice seems to rest between routes Nos. 2 and 3.

Route No. 3 affords the shortest line of communication between Lakes Manitoba and Superior, being from 18 to 20 miles shorter than by route No 2.

Route No. 2 is the shortest through route and involves the construction and maintenance of about 64 miles of railway less than route No. 3.

The relative merits of the two points, which would be touched on the shores of Lake Superior, for the purpose of transferring freight or passengers from the railway to steamboats, is a matter for consideration in determining which route should be adapted. I have already laid before the Government all the information I have collected on this subject; from which it would appear that the advantages of either point, as a harbour, do not materially preponderate over those of the other.

I refer to the Appendix for further information respecting Nepigon and Thunder Bay, the two harbours referred to. (Appendix I, page 207.)

The engineering features of routes Nos. 2 and 3 are similar. The same watersheds are passed over by both routes, and the same general elevation attained at the leading points. As both routes have the same leading features, I propose limiting my description to route No. 2.

Commencing at the southeasterly angle of Lake Nipissing, the whole distance to Lake Ellen, on Nepigon River, is about 557 miles. The line at Lake Nipissing is 730 feet, and at Lake Ellen 604 feet, above sea level. Between these two extreme points, the route passes over two main summits, one about 110 miles northwesterly from Lake Nipissing, at an elevation of 1420 feet above the sea, and the other about 70 miles easterly from the River Nepigon, elevated 1400 feet above the sea. Between these two summits, for a distance of over 370 miles, there is a long flat basin characterized by no great inequalities. The line for this long distance, will be generally very level, the ground averaging from 1000 to 1200 feet above the sea; at one point only, River English, does it dip to 830 feet.

The route, for nearly the whole distance east of Nepigon, runs behind the rugged and elevated belt of country which presents formidable obstacles on the immediate shores of Lake Superior. This rough district is crossed directly back of Lake Ellen where it is narrow and probably least forbidding. In consequence, about 25 or 30 miles of the line northeasterly from Nepigon river will show heavy work, while the remainder of the distance to Lake Nipissing, about 530 miles, will, it is believed, be comparatively light.

An examination of the accompanying diagram will show the general gradients on this route. It will further assist in forming a correct idea of its more prominent engineering features, if comparison be made with well known existing Railways.

In ascending westerly from Lake Nipissing, the rise to the highest point is less, and the length of line occupied in making the ascent considerably greater, than in passing from Lake Ontario to Lake Huron by railways in operation across the peninsula of Western Ontario.

The Great Western	ascends	753	feet in	44	miles.
The Grand Trunk	"	967	"	38	"
The Grey and Bruce	"	1398	"	52	"
The Northern	"	748	"	27	"

The total rise on the Pacific line north-westerly from Lake Nipissing to the highest summit east of Lake Superior is 690 feet, and the ascent is spread over a distance of 110 miles: thus indicating an average rate of ascent more favorable than on the Railways alluded to.*

The above will be sufficient to show that a route has been found, through a long section of the country, much more favourable than was hitherto expected, or even thought possible.

I now refer to the route west of Luke Superior:

	Above the Sea.	
******Canadian Pacific Railway.*		
Elevation of main summit, between Lakes Nipissing and Superior	1,420	feet.
Elevation at Lake Nipissing	730	"
Total rise in 110 miles	690	"
Great Western Railway.		
Elevation of summit between Hamilton and Detroit	995	feet.
Elevation at Hamilton	242	"
Total rise in 44 miles	753	"
Grand Trunk Railway.		
Elevation of summit between Toronto and Sarnia	1,209	feet.
Elevation at Toronto	242	"
Total rise in 38 miles	967	"
Toronto, Grey and Bruce Railway.		
Elevation of summit between Toronto and Owen Sound	1,640	feet.
Elevation at Toronto	242	"
Total rise in 52 miles	1,398	"
Northern Railway.		
Elevation of summit between Toronto and Collingwood	990	feet.
Elevation at Toronto	242	"
Total rise in 27 miles	748	"
Toronto and Nipissing Railway.		
Elevation of summit north of Toronto	1,128	feet.
Elevation at Toronto	242	"
Total rise in 35 miles	888	"

I think the line should be located so as to have the best possible alignment, with no heavier gradients than the maximum referred to. But the importance of securing the benefits of an unbroken steam communication at the earliest moment are so great that I consider that it would be advisable, in the first instance, to construct the cheapest possible line. While adhering to the permanent location in the main, I would with a view of accomplishing the desired object recommend the con-construction of a cheap temporary line, avoiding for the present all costly permanent works that would retard its completion. In order to gain access to the country as speedily and cheaply as possible it might, indeed, become necessary to overcome special difficulties by adopting temporarily, for short distances, deviations from the true location with heavy undulating gradients and sharp curvature. I have no reason, however, to think that this expedient would frequently be required. I am satisfied that for the greater part of the distance between Lake Superior and Manitoba, the permanent location may be substantially adhered to.

With regard to materials for building purposes, I have every reason to believe, that no great difficulty will be experienced on this score. The Woodland Region fortunately possesses an abundant supply of timber, suitable for Railway work, and will be able to furnish all that may be required in the Prairie Region.

I will now refer to the question of distance between a common point in the Province of Manitoba and points to the east, by the Canadian Pacific Railway, and by rival routes through the United States, and I should state that the distances about to be submitted are ascertained from recently acquired data and are believed to be approximately correct.

Taking Fort Garry* and Sault Ste. Marie as two common points, the following comparison may be presented.

No. 1.

From Fort Garry to Sault Ste. Marie	miles. Rail.	miles. Water.	Total. miles.
Via the Railways built and proposed to Duluth, thence by water	476	380	856
" Canadian Pacific Railway to Nepigon, thence by water....	416	248	664
Difference in favour of the Canadian Route....................	60	132	192

With respect to the distance from Fort Garry to the cities of Toronto and Montreal by the Canadian Pacific Railway, and by the most direct *all rail* routes built or proposed *via* Pembina and Chicago,

No. 2.

From Fort Garry to Toronto and Montreal, *all rail,*	To Toronto.	To Montreal
via The Canadian Pacific Railway to Nipissing and continuations...	1173	1288
" Pembina and Chicago, Detroit, &c..	1589	1925
Difference in favor of the Canadian Pacific Railway..................	416	637

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* The Stone Fort in each case.

Assuming the Duluth Railway to be extended along the south shore of Lake Superior to Sault Ste. Marie, the outlet of Lake Superior bridged at that point, and the Railway continued thence into Canada by the north shore of Lake Huron, thus forming the most direct possible connection between Duluth and the cities of Canada, the comparison would stand as follows:

No. 3.

From Fort Garry to Toronto and Montreal, *all rail*,	To Toronto	To Montreal.
via The Canadian Pacific Railway to Nipissing and continuations....	1173	1288
" Pembina, Duluth, and Sault Ste. Marie..................................	1296	1446
Difference in favour of the Canadian Pacific Railway................	123	158

The first comparison shows that the route via Nepigon, from Fort Garry to Sault Ste. Marie and all points East, will have 60 miles less rail and 132 miles less water than via Duluth.

The second comparison establishes the fact that the Canadian Pacific Railway will bring Toronto 416, and Montreal 637, miles nearer Fort Garry than they are by the most direct route, via Chicago and Pembina.

The third comparison shows that by the most direct continuation of the United States Railway, that could be built from Duluth easterly, the distance to Fort Garry from Toronto, Montreal and other points in Canada, would be considerably greater than by the route of the Canadian Pacific Railway.

Assuming that portion of the Canadian Railway from Manitoba to Lake Superior to be established, and thus a Canadian port on that lake placed in the same relative position as Duluth, we may draw a comparison between the railway routes projected from these ports easterly.

Taking a common point near the southeast angle of Lake Nipissing, the distance to Nepigon is under 560 miles, while the distance to Duluth is about 675 miles. The Canadian route would, accordingly, involve the construction of 115 miles less railway, than the most direct line *via* Sault Ste. Marie through the United States to Duluth. Comparison No. 3 establishes the fact that by the former route Toronto and Montreal would be from 120 to 150 miles nearer Fort Garry than by the latter.

The Canadian route must, therefore, remain unrivalled.

These comparisons, moreover, undoubtedly suggest that the Canadian line will not only command the traffic of Manitoba and the whole northwest, but that it will be in a position to draw traffic from Minnesota and the territories of the United States, south and west of Pembina.

A map of the country between Lakes Manitoba and Ontario has been prepared to accompany this report for the purpose of showing the projected route of the Canadian Pacific Railway above referred to. (See sheet No. 10.)

CLIMATIC DIFFICULTIES.

In a territory covering so large an area, embracing lofty mountain chains, elevated plateaus, vast lowland plains, extensive forests and great lake basins, it might be expected that the climate would prove almost as diversified as the physical features of the surface.

The configuration of the Continent, without any question, has an important bearing on the climatology of the several regions under consideration. Variation of temperature and humidity of the atmosphere are influenced in a remarkable manner by physical characteristics. The latter condition concerns us most, as upon it depends the snow-fall, and it is the depth of snow which mainly determines the regularity with which a railway may be operated during winter.

It is well known that, with the exception of the islands on the Pacific Coast, no part of Canada is exempt from an occasional recurrence of very low temperature, during the winter season. Experience has, hovever, taught us, in building our public works, how to deal with frost, and if we cannot wholly avoid the influence of a low temperature and great variation in temperature, we can by proper care and forethought guard against them, and greatly lesson their destructive effects.

With regard to the snow-fall, some important facts have been brought to light by the survey. We have had parties in the field during winter, in nearly every section of the vast territory. From these parties and from other reliable sources important information has been obtained, to admit to some extent of generalization. A correct idea of the snow-fall at the different points may be obtained by comparison with some well known place, such as the City of Ottawa.

Throughout the whole of the Woodland Region the depth of snow is generally less on an average than it is at the City of Ottawa. Only in one locality on the routes favorable for the railway, between Manitoba and Lake Nipissing, is the snow found generally so deep as at this city. The locality referred to is in the immediate neighbourhood of Lake Superior, where the routes approach the coast; here the lake appears to have a local influence on the humidity of the atmosphere, and, in consequence, on the amount of snow-fall. With this exception, the depth of snow on the route east of Lake Nepigon is found to be from 20 to 30 per cent. less than at Ottawa, gradually increasing to the east and south. From Lake Nepigon to Manitoba the snow ranges from 70 to less than 50 per cent. of the depth at Ottawa.

Throughout the Prairie Region the snow rarely exceeds 20 or 24 inches in depth, frequently not half so much over wide areas.

In the Mountain Region the climatological phenomena are more marked and the depth of snow-fall more varied. It appears that the western slopes of the Cascade and Rocky Mountain Chains, exposed to the vapor-laden winds from the Pacific, receive a bountiful supply of rain in summer and snow in winter, while, on the eastern

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ecipitation takes place.

the shores of the Pacific to the increase in altitude. In the of snow-fall varies greatly, according to the prevailing winds.

gical data, meteorological observations in the Rocky Mountains, during these observations has been examined that gentleman has kindly furnished which I submit with a report by Mr. of the Rocky Mountain Zone where

documents referred to, that the deepest Thompson is found between Stillwater and reaches five feet. Between Lake Albreda and about four feet. In the first week in March, Head Pass was two feet.

Athabasca Depot, 22 miles easterly from the six and a-half inches, at any one time, during surveying party experienced, what the resident at Edmonton and Jaspar House considered, an found it less severe in the district referred to than

a complete analysis of the meteorological register. surveying party in the mountains, and has constructed between the minimum temperature and the Mountain stations and various places in Ontario, Provinces. From these tables it will be observed, that, Mountain stations are liable to a cold much exceeding compares favourably, and in spring the mountain stations With regard to snow, the total depth, recorded for Depot in the Jaspar Valley, is remarkably light compared following abstract will show:—

quarter,	at Depot, Jaspar Valley	10	inches.
	at Toronto	50.7	"
	at Ottawa	52.2	"
	at Montreal	74.1	"
	at Quebec	102.7	"
	at St. John, N.B	70.1	"
	at Bathurst (Bay Chaleur.)	112.3	"
	at Halifax, N.S.	49.5	"
	at Howse Pass	70.0	"

The character of the winter climate, on the eastern approach through the Rocky Mountains to the Yellow Head Pass, may be judged from the fact that about one hundred horses and mules, engaged on the survey, were obliged to shift for themselves during the whole winter. These animals, much worn out by excessively hard work and nearly starved when they reached the Jaspar Valley, were turned out in mid-winter to pick up what they could get. Not a single death occurred, and they all resumed work in March in fair condition. Jaspar Valley is fully 3300 feet above the level of the sea, and nearly ten degrees of latitude farther north than Toronto.

The locality referred to is exceptionally exempt from snow, on account of being sheltered from the Pacific winds by the high mountain chain immediately to the west. Some distance to the east, the snow-fall is undoubtedly deeper, but at no point on the projected line of railway between Jaspar Valley and Edmonton, where it passes through thick forest for part of the way, will it much exceed half of the depth found at Ottawa.

I have already stated, that the snow-fall is found to be much greater on the western than on the eastern side of the Rocky Mountain chain. The same characteristic is even more marked in the Cascade chain, although the latter is not the dividing ridge of the continent. From all that can be learned, the snow, although averaging from four to five feet in depth in many places along the western slope of the main chain, diminishes on the central plateau, as the base of the Cascade Mountains is approached.

The Indians at Lake Tatla, on the Chilcotin plains, have a considerable band of horses, and these animals subsist during every winter in the open air, on what they can pick up. This they could not do, if the snow was of great depth. In reply to enquiries, the Indians say that the snow on the level reaches, at times, a little above the knee, probably not much over two feet.

In all the passes through the Cascade chain, the snow is reported to be deep, and it is probable that in any route adopted, through the Canyons of this range, snow sheds would be required to protect the line from snow-drifts and snow-slides.

As the sea level is approached the snow diminishes, in proof of which, one of the surveying parties found several mules in good condition that had been left by the late Mr. Waddington, near the head of Bute Inlet, eight years before. These mules had been left without any protection or provision for winter during the whole period.

It is evident from the number of facts collected, that, throughout the whole extent of country between Ottawa and the Pacific Ocean, there are no serious climatic difficulties to be apprehended that cannot be overcome in the usual way.

The only localities where snow may be met in quantities, equal to the maximum in the eastern Provinces of the Dominion, are on the western slopes of the two great mountain chains in British Columbia. In the Cascade Chain it will, in some places, exceed the maximum referred to, and here it will probably be necessary to protect the railway by snow-sheds.

With these exceptions, it is believed that, if the roadway be raised a few feet above the general level in the open prairies, and other means adopted to prevent drifts snow will really offer less obstruction on the Canadian Pacific Railway than it does on lines now worked in Ontario, Quebec and in the other Eastern Provinces.

LOSS OF LIFE ON THE SURVEY.

The results of the Pacific Railway Survey, now respectfully presented, which I trust may be considered, in many respects, satisfactory, have not been attained without disaster. The destruction by fire of the railway offices, with many valuable records, has been alluded to. It is my sad duty to record the loss of twenty-one men who were engaged upon the work of exploration. Of these seven perished in forest fires, and twelve were drowned.

These men, together with the remaining two, lost their lives through causes incidental to their duties, and entirely beyond control. I have already brought these painful cases under the notice of the Government, and the documents submitted (Appendix Q) show that the Government, in recognition of the fact that they perished in a laborious and hazardous service, has granted a compensatory allowance to their representatives.

The members of the Engineering staff have undertaken to establish a memorial in memory of their lost associates.

CONCLUSION.

In submitting this Report, with the voluminous appendices, I respectfully consider that I am justified in thus summarizing its conclusions:

1. That, although the information respecting the Rocky Mountain Zone is not yet sufficiently complete to establish the line to the Pacific, several routes have, however, been found, on which the obstacles met with, although formidable, are not insuperable.

2. That there are reasonable grounds for the belief that the explorations in progress in British Columbia will result in the discovery of a line through the Rocky Mountain Region, which, taking everything into consideration, will be more eligible than any yet surveyed.

3. That it is now established beyond doubt, that a favourable and comparatively easy route, considering the line as a whole, has been found from Ottawa to the northerly side of Lake Superior. This result is the more satisfactory, as unfavourable impressions had been created regarding this portion of the country, many having considered it even impracticable for railway construction.

4. That it will be possible to locate the line direct from the northerly side of Lake Superior to the Prairie Region, without unusually expensive works of construction, at the same time with remarkably light gradients in the direction of the heavy traffic.

5. That the main line from Ottawa to Manitoba can be located in such a way as to render unnecessary the construction of a branch, to reach the navigable waters of Lake Superior.

6. That there will be no difficulty in finding a comparatively easy route across the Prairie Region; that the bridging of the large rivers, with proper care in location, will form no large proportion of the cost of the whole extent of railway.

7. That the lakes and rivers of the Prairie Region may be advantageously used in the introduction of settlers and in the construction of the railway.

8. That, with respect to operating the railway in winter, the chief difficulties will be found on the western slopes of the two great mountain chains in British Columbia, but, except in these localities, the Canadian Pacific Railway will have, on an average, considerably less snow than existing railways have to contend with.

9. That the practicability of establishing Railway communication across the Continent, wholly within the limits of the Dominion, is no longer a matter of doubt. It may indeed be now accepted as a certainty that a route has been found, generally possessing favourable engineering features, with the exception of a short section approaching the Pacific coast; which route, taking its entire length, including the exceptional section alluded to, will on the average show lighter work and will require less costly structures, than have been necessary on many of the Railways now in operation in the Dominion.

I have the honour to be,
Sir,
Your obedient servant,
Sandford Fleming,
Engineer-in-Chief.

TABLE No. 1.—Estimated Through Distances. *

From points on the Pacific Coast.	Intermediate distances and totals to L. Nipissing.	Total Miles. To Toronto.	To Ottawa.	To Montreal
Burrard Inlet, by Route No. 1, to Edmonton	754			
Edmonton to Fort Garry	780			
Fort Garry to Lake Nipissing	973			
Total distance from Burrard Inlet	2507	2707	2710	2822
Burrard Inlet, by Route No. 2, to Edmonton	790			
Edmonton to Nipissing as above	1753			
Total distance from Burrard Inlet	2543	2743	2746	2858
Howe Sound, by Route No. 3, to Edmonton	753			
Edmonton to Nipissing, as above	1753			
Total distance from Howe Sound	2506	2706	2709	2821
Bute Inlet, by Route No. 4, to Edmonton	846			
Edmonton to Nipissing, as above	1753			
Total distance from Bute Inlet	2599	2799	2802	2914
Bute Inlet, by Route No. 5, to Edmonton	806			
Edmonton to Nipissing, as above	1753			
Total distance from Bute Inlet	2559	2759	2762	2874
Bute Inlet, by Route No. 6, to Edmonton	872			
Edmonton to Nipissing, as above	1753			
Total distance from Bute Inlet	2625	2825	2828	2940
North Bentinck Arm, by Route No. 7, to Edmonton	950			
Edmonton to Nipissing, as above	1753			
Total distance from North Bentinck Arm	2703	2903	2906	3018

TABLE No. 2.—ALL RAIL ROUTES,—From Fort Garry Eastward.

From Fort Garry. (The Stone Fort in each case.)	To Toronto.	To Montreal
Via the Canadian Pacific Railway, to Lake Nipissing, thence to Toronto and Montreal	1173	1288
Via most direct United States Railways, made or proposed, to Chicago, thence by shortest existing Railways to Toronto and Montreal	1589	1925
Differences in favour of Canadian Pacific railway	416	637
Via the Canadian Pacific Railway, as above	1173	1288
Via the Railways, built and proposed, to Duluth, thence by the shortest line along the South shore of Lake Superior and the North shore of Lake Huron	1296	1446
Differences in favour of the Canadian Pacific Railway	123	158

TABLE No. 3.—MIXED RAIL AND WATER ROUTES.—From Fort Garry Eastward.

From Fort Garry to Sault Ste. Marie.	Rail.	Water.	Total.
Via United States Railways, built and proposed, to Duluth, thence by Lake Superior to Sault Ste. Marie	477	396	873
Via Canadian Pacific Railway, to Nepigon, thence by Lake Superior to Sault Ste. Marie	416	254	670
Differencin favour of the Canadian Pacific Railway	61	142	203

* Continuous measurements, have in no case yet been made, distances must, therefore, still be considered approximate.

Canadian Pacific Railway.

APPENDICES TO THE REPORT

OF THE

ENGINEER-IN-CHIEF.

APPENDIX A.

EXPLORATORY SURVEY CANADIAN PACIFIC RAILWAY.

Brief notes on the character of the country traversed across the Continent in 1872 *by the Expedition of Sandford Fleming, the Engineer-in-Chief.*

After visiting Nepigon, we proceeded to Thunder Bay, and leaving the shores of Lake Superior, commenced our land journey northerly and westerly, on the morning of the 22nd July.

From Prince Arthur's Landing to Lake Shebandowan, a distance of 46 miles, the road mostly runs in the valley of the Kaministiquia. The first 25 miles to the Matawa appears adapted for settlement, the soil is sandy loam, with a subsoil of clay. The flora is proximately the same as the country north of Lake Ontario. The surface is undulating and generally not difficult to clear, few settlers however have found a home here.

The remaining twenty miles to lake Shebandowan appear to be inferior in character; the timber is not heavy on the shores of this lake. It improves, however, on lake Kashabowie. It is to the north of this lake that the summit is met and the waters run in opposite directions; on the one hand to the north and west, finally passing into Hudson's Bay, on the other hand to the east and south, feeding Lake Superior and the St. Lawrence. The first of this new system of waters, the Lac des Mille Lacs and the succeeding Lakes are well wooded, the principal timber being pine, aspen and birch. At Lake Kaogassikok, more larch and cedar is met, a circumstance which suggests a locality where railway ties may be found, it being possible to raft them from this point to Winnipeg. The timber, indeed, somewhat improves in character and dimension from this locality; the country is also somewhat more rolling, and in many parts has the appearance of cultivation. On Rainy Lake, however, the shores are rocky and the timber is small, especially on the northern side. Rainy River flows through a more fertile country; where visible from the river the soil seems good and easy of clearance. The predominating timber is aspen, but it is interspersed with maples, pines and elms, and the country appears well adapted for settlement.

The writer had but a limited opportunity of forming any opinion of the country surrounding the Lake of the Woods, having only sailed through its waters.

From the Northwest Angle to Red River, more positive opinions may be expressed. This District, is somewhat monotonous in appearance, but nevertheless seems capable of development. The first twenty miles lie somewhat low, in many places; it is, in its present state, swampy and will require extensive drainage. It is abundantly wooded with spruce, tamarac and pine, with white birch and aspens. The soil is clay with a covering of black loam, but this characteristic is lost, as the traveller advances west, the soil becoming more sandy. The flora is generally that of Central Ontario, possibly marked by a greater variety of species.

At Oak Point, thirty miles from Fort Garry, the prairies are met; and a small stream, the Seine, runs from this point into Red River. The land for two miles is taken up by the Metis. The grass is green and luxuriant, interspersed with flowers and all the features of a prairie landscape are to be seen in full profusion.

Of the distance traversed between Lake Superior and the Red River, no positive opinion, of the extent fit for settlement, can be pronounced by travellers, taking the

Dawson route. Special examination must be made of each locality, before any estimate, worthy of attention, can be made. So far as the writer is capable of judging, it may be said that the land along Rainy River and some parts of the shores of the Lake of the Woods, offer fair inducement to the settler, but the real character of the country can only be known after careful and systematic exploration.

From Fort Garry, the route lay along the valley of the Assiniboine River, which although a tributary of the Red River, is itself the centre of a system of waters. At Fort Ellice, about 220 miles distant from Fort Garry, the water flows from northern sources and the trail entirely leaves the stream. Taking its origin between the 52nd and 53rd parallel of latitude, between the 102nd and 104th line of longitude, it descends to Fort Ellice, between the 50th and 51st parallel of latitude, somewhat to the east of 102 degree of longitude. At Fort Ellice, however, it receives the tributary River Qu'appelle, which runs for nearly four degrees of longitude between the 50th and 51st lines of latitude. The soil of the Assiniboine Valley is remarkably fertile, for a distance of 70 miles. Westward of Fort Garry a few settlers have taken up land. The remaining distance of 150 miles is without a single settler, the last being found at Rat Creek. Hitherto there has been no inducement to the settler to come here.

If reliance can be placed on replies to the enquiries made, no difficulty has so far been experienced in the Assiniboine Valley, with regard to the supply of wood. The same might be said with regard to water; where wells have been dug, water has been found, with few exceptions.

The winters are described, by the few settlers we saw, as very pleasant. Cold, of a low temperature, commences to be felt sometime in December, generally about the middle of the month, and the thaw takes place in the early weeks of March; the snow seldom exceeds two feet in depth. The sun is generally bright, and the air sharp and free from dampness. So far as evidence can be gathered in this respect, the inference may be drawn, that the railway will not be impeded by heavy falls of snow, of great depth and of frequent recurrence. The drifts, which occur in all longitudes where snow lies on the earth continuously throughout the winter, it is feared, cannot wholly be avoided. Experience, however, has suggested in each individual case the mode in which the drift, if experienced, may be dealt with.

The country passed over, as the traveller proceeds westward, alters its character. The level prairie landscape met in the neighborhood of Red River gives way to more rolling land, while the soil is sandy loam, generally of good quality. The flora, as may be inferred, is no longer the same.

Before and after reaching Fort Ellice, we were occasionally at a loss for good water. All the running water is fresh and wholesome, but there are long stretches between the streams in some localities; the ponds which exist on the surface are frequently saline or brackish.

One very pertinent question arises, whether water of good quality can be obtained generally. The rivers with their tributary creeks are not invariably convenient to the best soil—in some instances they are at some distance from it. The question, therefore, is most important, for if good water cannot be obtained by moderate effort, the land, however outwardly pleasant to the eye, or intrinsically rich, can be little adapted for dairy farming. The expense of collecting rain water in cisterns and reservoirs is well known, and this difficulty has been experienced in much of the western territory of the United States.

The country as a field for settlement is accordingly lessened in value, where water has to be husbanded with jealous care, and where, indeed, every gallon must be collected in advance of its use. The writer suggests the propriety of this question being carefully investigated as an independent inquiry. The practical mode of meeting it, would be to sink wells at intervals on some principle of geographical division, and so determine the qualities of a district of a given area in this respect. The fact must not be put out of sight, that the opinion is entertained, that there are places where water will be met, only at very low borings. Failure to obtain it at any cost, may, indeed, result in particular localities, but the general opinion appears to be that it will not be found difficult to obtain water. No facts are, however, assured, and many authentic data are necessary before any generalization can be made. If established as a truth that the supply of water is certain in all directions, a great impetus will be given to emigration. As a problem which must force itself on public attention, it should be examined without delay.

For a limited distance to the westward of Fort Ellice the land is light and sandy, but it again shortly becomes richer and less light, and the country is more rolling and broken. For some distance, it may be described as being a series of shallow basins enclosed in a larger periphery. The higher land on the ridges may be described as being somewhat gravelly, while that of the low land is rich with peaty mould. Proceeding towards the Touchwood hills, we met gentle slopes crowned with the aspen, with occasional small lakes, fringed by willows, many of them saline.

Much of the land has been devastated by fire, and it is thought that this cause, repeated frequently, has, after a series of years, resulted in the entire destruction of the heavy wood which, it is believed, once covered the surface of these prairies. The aspens, however, quickly grow up, five or six years life making them sufficiently large for fencing purposes.

About 110 miles to the northwest of Fort Ellice the Touchwood Hills are met. These are mere undulating eminences, partly wooded, with remarkably good soil and apparently well adapted for settlement; they gradually descend on the western side. Some difficulty was found in this neighbourhood in obtaining water; that which we could find was often brackish and scarcely drinkable, and seemed to be only the remaining deposit of last winter's snow.

Scarcely any rivers are met; it is observable, however, that several running streams are found farther north.

The route, on which we were travelling, explains this feature of physical geography, for we were on the water shed between the Assiniboine and the South Saskatchewan. We found that this part of the route is generally without timber, but it contains spots where slight wooded knolls are met. Apparently level, in reality there is a considerable ascent, as the country is travelled westward.

From Fort Garry to Fort Edmonton, there is a rise of 1400 feet in a distance of 900 miles by trail, while a farther rise of 900 feet is experienced before the base of the mountain chain is met. Thus the total additional elevation of 2300 feet is spread over 1000 miles, being at an average grade of 23 feet to the mile; in some portions of this, heavy rolling ground is found, and the soil varies in richness. Gravel is present on some of the higher ridges, and it is confidently believed, that there would be ballasting obtainable for railway purposes without great difficulty.

Before reaching the south branch of the Saskatchewan, the country, is an agreeable mixture of woodland and prairie with several lakes of moderate dimensions, and with a rolling succession of knolls. The landscape was unusually pleasing, the soil excellent, and we saw abundant wild flowers. Very many of the lakes are brackish, yet they often adjoin fresh water lakes; the latter we found invariably at a higher level. At the foot of a ridge they are more frequently saline; on mounting the slope they prove to be fresh.

At one place, we witnessed a fresh water spring at the edge of a lake, the latter so saline that the horses would not drink the water.

The crossing of the South Saskatchewan is about 250 yards wide, the banks are about 170 feet high; the eastern bank, however, has the greater elevation; aspens, balsams, poplars, and small white birch, are found on its banks; the valley of the river, however, extends over a mile in width. The North Saskatchewan is eighteen miles distant, and it is at here that Fort Carlton is established. Between the two rivers, the country assumes the appearance of a level plateau elevated about 300 feet above the streams. The soil, although light, is of good character; the north river at this spot is somewhat broader than the south branch. The streams unite near the 105th degree of longitude and discharge into Lake Winnipeg. Only one rapid of any great importance is met in this distance. Both these streams seem to form natural arteries of communication through the country where they have their course. Nothing as yet is, however, definitely known as to the limit of navigation they will admit; but they will probably be found navigable for steamboats of light draught, by removing sandbars and straightening some of the more crooked channels.

The country on the North Saskatchewan is but little wooded, but it abounds in grasses, and the soil appears to be good, in some places somewhat sandy and arid. The contour of the land is irregular, with hills of considerable elevation, at the base of which lakes are frequently to be met, generally not of extended area.

From Fort Pitt continuing along the North Saskatchewan, the soil improves, and we met white spruce, tamarack, and poplars, with thick and luxuriant grasses. Fires had passed over much of the country. As we came within 100 miles of Edmonton, the country became more hilly, and the hill sides were covered with heavy wood. The flora continued the same as on the eastern prairies, but it was here somewhat more luxuriant; a good deal of low birch and scrub pine, ***pinus Banksiana***, is met in this locality. At Edmonton the question of coal first presents itself; some fragments were dug out of the river bank. Although they burned in a blacksmith's forge, evidently they were of inferior quality; better samples were reported by the officers of the Hudson Bay Fort, as having been found higher up the river.

All the rivers we crossed between Prairie Portage and Edmonton are marked by the characteristic of running in wide and deep valleys; this peculiarity would appear to extend generally to the prairie region of the Northwest, except, perhaps, the lower portions of it around Lake Winnipeg. However small the stream which runs through them, the valleys have the same characteristics. The circumstance suggests no special engineering difficulty, but it points to heavy expense in construction where rivers are to be crossed, and the necessity of care and judgment in laying down the route, so as to keep the expense within as moderate limits as possible.

Looking back over the thousand miles of prairie country travelled since leaving the wooded district east of Manitoba, it is worthy of note, that absolutely level plains formed no great proportion of the vast area which came under our observation. We were agreeably surprised to find that by far the larger proportion was undulating and in this respect not unlike much of the Province of Ontario, while eminences of considerable elevation, not greatly inferior to the Mountain at Montreal, were occasionally met with. In many places small groves and fringes of trees adorned the prairie and gave the landscape an agreeable, park-like appearance.

Before reaching Edmonton we received from gentlemen connected with the Hudson Bay Company and from others engaged in missionary labours, most favourable accounts of the country on Peace River to the North, and still more glowing descriptions of the beauty of the landscape and fertility of the soil over broad districts stretching away to the South towards the International boundary line.

A few weeks after we left Edmonton, Colonel Robertson Ross travelled southerly through the section referred to. He reported the country for about 300 miles in length along the eastern base of the Rocky Mountains, towards the 49th parallel, and from 60 to 80 miles in breadth, to be of great natural beauty, with soil of surpassing richness. Here is found the favourite wintering ground for great herds of buffalo.

At Edmonton our party was separated, one portion diverging to examine the Peace River District and Pass, while the main expedition pursued its course directly towards the Mountains.

On leaving Edmonton we passed through a country interspersed with hillocks and we likewise occasionally met with swamps, many of which were covered with swamp hay. Gradually the country becomes more wooded, and the undulations assume a more marked character. More creeks were crossed, running in most cases through narrow valleys. The vegetation was particularly luxuriant, and the grass through which we passed was in some places from five to six feet high.

In crossing the River Pembina some seventy miles west of the River Saskatchewan, we found thick outcropping beds of coal. It proved much better than the Edmonton specimen, and we heard from our guides that abundance of this fuel was present at other localities, some of it of still better quality.

Occasionally the country becomes more open with groves of spruce, aspen, and poplar, increasing in size. Nevertheless much of it is densely wooded, while in other places the timber is thin and of inferior quality.

The ascent up the McLeod River was continued for seventy miles. There was no regular trail, and the route of the party was through innumerable windfalls. Much of the soil is bog, and the banks of the river are rough and rugged. The advance made was slow and tedious. Pushing across the intermediate summit, the River Athabaska was reached. This stream runs through cliffs of sandstone, shale and clay, and the valley widens by a succession of terraces, rising one above the other. They are very distinctly marked on both sides of the stream. It was here that we obtained the first view of the Rocky Mountains, which rise in all their grandeur, presenting as it were an impenetrable wall before us. The ground alternated in its character. The trail gradually approaches the river and passes up the valley, which is here about five miles wide. Following the windings of the river, we reached the portals of Jasper Valley, entering which we were literally in the very heart of the mountains. So easy an ingress could never even have been hoped for.

Jasper House is but 3,300 feet above the sea. Lake Jasper is ten miles long. After leaving the River Athabaska, the path of the expedition lay along the River Miette. It was here that the trail of the advancing party from the Pacific was first seen, and immediately afterwards the delivery of a letter from the officer in charge established the certainty of the party being in close neighborhood. The meeting took place near the junction of the Miette with the Athabaska. The name of Caledonian Valley has been given to this locality by the Hudson Bay Company. It is rocky and rough, and the river itself is a series of falls and rapids. The lower ground of the valley is swampy, with an underbrush of scrub birch and of dwarf willows. The trail crosses the river seven or eight times in a very short distance.

The immediate ascent to the Yellow Head Pass is not difficult, and the Pass itself is, as it were, an open meadow.

It was the middle of September when we arrived in the Yellow Head Pass, but the flowers were in bloom, and the lower slopes of the mountains were covered with verdure. Above them rose huge rocky masses, crowned with perpetual snow.

Leaving the meadow at the summit of the Pass, we immediately struck one of the sources of the River Fraser. The passage from the Miette to the former river, is so gentle that it is barely perceptible, and it would be extremely easy to make the summit water flow in either direction. Following the waters of the Fraser, our exploration took us past, first, a sheet of water about ten miles in length, which we named Yellow Head Lake; second, by Lake Moose, a body of water of some extent, from which the Fraser River rapidly descends.

About sixty miles beyond the Yellow Head Pass, we came to a turn in the River Fraser, named Tête Jaune Cache. Here the Fraser takes a northwesterly direction, to nearly midway between the 54° and 55° parallel, when it descends southerly almost to the 49° parallel, then turns to the west, to meet the Pacific waters near New Westminster. Our course, therefore, being southward, we turned towards the River Canoe, passing over the low height of land between the two streams, entirely abandoning the Fraser at Tête Jaune Cache, again to meet it by the valley of the Thompson, at Lytton, more than four hundred miles distant.

The Yellow Head Pass is less than 3,800 feet above the sea. The passes in other directions to the South are considerably higher, and the crest of the mountains will probably exceed 9,000 or 10,000 feet.

Our route took us through a country remarkably well wooded with spruce, hemlock, cedar, white birch, and the Douglass fir. We left the Fraser at the Tête Jaune Cache, and found a country wonderfully level, considering the magnitude of the mountains by which it is enveloped, to the River Canoe. Our course ran to the east of Lake Cranberry, a small body of water situate between the two streams.

Crossing the River Canoe, which we were able to ford, we passed to the east of Lake Albreda, which is somewhat smaller than Lake Cranberry and situated between the Canoe River and the North Branch of the Thompson, much in the same position as the former named lake. On reaching the Thompson, the river was at once crossed, and we descended the north Branch on the west side of the valley; our trail was extremely rough and undulating. The valley itself is narrow and in places appears as a mere gorge. Several streams of great width were crossed in our descent. The valley widens as it is descended, but again becomes narrow and full of difficulty. Ten or twelve miles over this trail, the canyon, the *Porte d'enfer* is met, which is very rugged and presents obstacles which would entail considerable expense to overcome. When passed, the valley again widens and the steep spurs of the mountains recede from the river. The water of the river runs with a quiet current, as its name "Stillwater" suggests, but the descent again becomes rapid and the stream falls 750 feet in the 45 miles, immediately above Clearwater. In the succeeding 73 miles, the fall is 240 feet.

From Clearwater to Kamloops, a distance by trail of about 75 miles, the river is navigable for boats. It was on this portion of the journey, that we came upon the first trace of settlers, now on farms north of Kamloops. The first we saw was a small saw mill, 15 miles north of that place.

At Kamloops and the surrounding district the character of the country changes; it is arid and generally treeless, the surface being covered with bunch grass.

But little rain falls on the intervening territory between the two great chains, which in this latitude distinguished the Rocky Mountain zone. Hence one of the necessities inseparable from farming is an artificial supply of water. The settlers have already established works of irrigation, and are reported to conduct their farming operations with profit.

The country possesses this arid character until we enter the Cascade Range, between Cache Creek and Lytton; at the latter point the Fraser is rejoined and it flows mainly through canyons to the head of steamboat navigation at Yale.

We reached Yale, the head of steamboat navigation, on the 3rd October, and New Wesminster the following evening, next day we were on the waters of the Pacific ocean.

ITINERARY

OF THE

Expedition of Sandford Fleming, the Engineer-in-Chief, across the Continent.

DATE.	DESIGNATION OF PLACES BY THE WAY.		ESTIMATED MILES TRAVELLED.				
			LAND.		WATER.		TOTAL.
1872.			Rail.	Horses.	Steam'r.	Canoe.	
July 1	From Halifax, along the route of the Intercolonial Railway, under construction and partly in operation, to Rivière du Loup.	To Truro	61				
		" Moncton	50	76			
		" Miramichi	19	......	115		
		" Bathurst	......	45			
		" Metapedia	......	80			
		" Rimouski	......	110			
		" Riv. du Loup	......	66			622
July 9	From Rivière du Loup along the Grand Trunk, St. Lawrence and Ottawa and Northern Railways to Collingwood.	" Quebec	126				
		" Montreal	166				
		" Ottawa	166				
		" Toronto	275				
		" Collingwood	94				827
July 16	From Collingwood by steamer through the Georgian Bay, Lake Huron and Lake Superior to Thunder Bay.	" Owen Sound	......	......	45		
		" Killarney	......	......	100		
		" Bruce mines	......	......	135		
		" Sault Ste. Marie	......	......	50		
		" Michipocoton Island	......	......	115		
		" Nepigon	......	......	150		
		" Thunder Bay	......	......	100		605
July 22	From Thunder Bay along the Dawson route to Fort Garry... *Camp No. 1	" Shebandowan	......	45			
23	.... " 2	" Brule Portage	......	......	......	60	
24	.... " 3	" Camp Ignace	......	......	......	35	
25	.... " 4	" American Portage	......	......	......	61	
26	.... " 5	" Rainy Lake	......	......	......	60	
27	.... " 6	" Hungry Hall	......	......	......	90	
28	.... " 7	" Island Camp	......	......	......	8	
29	.... " 8	" Northwest Angle	......	......	......	70	
30	.... " 9	" Oak Point	......	80			
31	.... " 10	" Government House	......	80			539
			Carried forward				2,683

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* Camps numbered from Lake Superior.

ITINERARY.—*Continued.*

DATE.	DESIGNATION OF PLACES BY THE WAY.			ESTIMATED MILES TRAVELLED.				
				LAND.		WATER.		TOTAL.
1872.		Camp.		Rail.	Horses.	Steam'r.	Canoe.	
			Brought forward....	......	......	......	......	2,688
Aug. 1	From Fort Garry to Stone Fort and back.		To Government House....	.....	40			40
2	From Fort Garry to Fort	No. 11	" White Horse Plains.....	......	83			
3	Ellice.*........................ "	12	" Rat Creek Camp.......	......	37			
4	.... "	13	" Three Creeks "	......	24			
5	.... "	14	" Camp Assiniboine.......	......	40			
6	.... "	15	" Salt Lake Camp	......	41			
7	.... "	16	" Qu'Appelle "	......	45			220
8	From Fort Ellice to Fort Carl- "	17	" Broken Arm River.....	......	81			
9	ton........................... "	18	" Lonely Tree Camp......	......	43			
10	.... "	19	" Little Touchwood "	......	41			
11	.... "	"	" " "	.. ...	"			
12	.... "	20	" Touchwood Camp......	......	43			
13	.... "	21	" Quill Lake Plain "	......	42			
14	.... "	22	" Round Hill "	......	43			
15	.... "	23	" S. Saskatchewan "	......	46			
16	.... "	24	" Fort Carlton "	......	18			307
17	From Fort Carlton to Fort Pitt. "	25	" Bears Paddling Lake .	......	38			
18	.... "	"	" "	.....	"			
19	.... "	26	" Jack-fish River Camp..	......	48			
20	.... "	27	" English River "	......	41			
21	.... "	28	" Fort Pitt Guard "	......	40			167
22	From Fort Pitt to Fort......... "	29	" Moose Creek Camp....	......	40			
23	Edmonton..................... "	30	" Snake Lake "	......	42			
24	.... "	31	" Victoria Mission "	......	40			
25	.... "	"	" " "	......	"			
26	.... "	32	" Deep Creek "	.....	44			
27	.... "	33	" Fort Edmonton "	......	27			193
28	From Fort Edmonton to Jasper "	34	" St. Albert Camp........	......	11			
29	House......................... "	35	" St. Anns' "	......	39			
30	.... "	36	" Round Lake "	......	12			
31	.... "	37	" Lobstick Creek "	......	29			
			Carried forward......	......	91	......	......	3,711

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* Distances between Fort Garry and Edmonton were measured by "Odometer."

ITINERARY.—*Continued.*

DATE.		DESIGNATION OF PLACES BY THE WAY.	Camp.		ESTIMATED MILES TRAVELLED.				
					LAND.		WATER.		TOTAL.
1872.					Rail.	Horses.	Steam'r.	Canoe.	
				Brought forward..	......	91	......	......	3,711
Sept.	1	From Fort Edmonton to							
	2	Jasper House.................	No. 38	To Valad's Camp	......	26			
	3	....	" 39	" Camp Minnie...........	......	23			
	4	....	" 40	" McLeod River Camp...	......	17			
	5	....	" 41	" Indian Camp	......	12			
	6	....	" 42	" Muskeg Camp	......	20			
	7	....	" 43	" Plumb Pudding Camp..	......	21			
	8	....	" "	" " ..	......	"			
	9	....	" 44	" Bayonette Camp.	......	25			
	10	....	" 45	" Beaver Camp	......	17			
	11	....	" 46	" Island Camp............	......	26			278
	12	From Jasper House to Yellow Head Pass.	" 47	" Jasper Lake Camp.....	......	4			
	13		" 48	" Athabasca Camp.......	......	25			
	14	....	" 49	" Caledonian Valley......	......	17			
	15	....	" 50	" Yellow Head Camp	......	4			50
	16	From Yellow Head Pass to...	" 51	" Moose Lake Camp......	......	40			
	17	Kamloops......................	" 52	" Herd Camp	......	4			
	18	....	" 53	" Camp Fraser..........	......	13			
	19	....	" 54	" Canoe River Camp	......	31			
	20	....	" 55	" Albreda Camp..........	......	25			
	21	....	" 56	" Camp Cheadle..........	......	26			
	22	....	" "	"	......	"			
	23	....	" 57	" Headless Indian Camp.	......	23			
	24	....	" 58	" Camp V.................	......	21			
	25	....	" 59	" Round Prairie Camp...	......	24			
	26	....	" 60	" Bunch Grass Camp.....	......	26			
	27	....	" 61	" Camp Thompson	......	12	......	25	
	28	....	" 62	" Kamloops................	......	......	......	60	333
	29	From Kamloops to New Westminster		" Kamloops	......				
	30	....		" Cornwalls	......	38	......	16	
Oct.	1	....		"	......	"			
	2	....		" Lytton	......	48			
	3	....		" Yale	......	56			
	4	....		" New Westminster	......	.....	96		253

Carried forward...................... 4,524

ITINERARY.—*Continued.*

DATE.		DESIGNATION OF PLACES BY THE WAY.		ESTIMATED MILES TRAVELLED.				
				LAND.		WATER.		TOTAL.
				Rail.	Horses.	Steam'r.	Canoe.	
1872.								
			Brought forward.. .	......	......	......	......	4,524
Oct.	5	From New Westminster to Victoria.	To Burrard Inlet..........	......	8	32		
	6	On board the steamer "Sir James	" Waddington Harbor....	......	......	190		
	7	Douglass.".........................	" Seymour Narrows......	......	......	80		
	8	....	" Nanaimo.......	......	......	100		
	9	....	" Victoria	......	......	80		490
	10	From Victoria to Alberni, Barclay Sound and back, steamer Sir James Douglas.	" Pacific Ocean...........	......	......	150		
	11		" "	......	......	150		300
			Total Mileage......	957	2,185	1,687	485	5,314

SUMMARY.

		Miles.
Distance travelled by Railway	....	957
" "	On horse back and on foot..	1,510
" "	By waggons, carriages, &c.....	675
" "	Steamers—on St. Lawrence and Pacific waters............................	1,687
" "	Canoes and row-boats..	485
From Halifax to Victoria between July 1st and Oct. 11th.	....................................Total Miles....................	5,314

APPENDIX B.

Instructions and Report respecting the Branch Expedition from Edmonton, via Peace River, to the Pacific Coast.

INSTRUCTIONS.

FORT EDMONTON, August 27th, 1872.

CHARLES HORETZKY, ESQ.:

MY DEAR SIR,—It is important that as much information as possible be obtained respecting the country extending from the waters of the North Saskatchewan, Northerly and Westerly by the Valley of Peace River to British Columbia, and thence to the coast line in the latitude indicated.

Having every confidence in your energy and ability, I have to request that you will at once proceed to make an exploration through the country, and obtain by personal observation and enquiry as much information as it is possible to acquire within the present year.

I have associated with you as Botanist Mr. John Macoun, who will specially attend to the collection of specimens illustrative of the flora of the district to be traversed, and information bearing on the agricultural capabilities of the country.

With the above objects in view, you will proceed by the speediest route to Dunvegan, and thence ascend by the Valley of Peace River across the Rocky Mountain range to the Omineca district in British Columbia. You will there learn as to the practicability of passing down the Skeena River to Port Essington, and if circumstances will admit of this route being taken, you will proceed this way to Victoria, unless it appear to you more advisable to take the Frazer River route.

In addition to information obtained from personal observation, you will make full enquiries of parties who may have travelled in the country, respecting its mineral resources (especially coal and iron), the climate, depth of snow at different points, the extent of land suitable for settlement, quality of soil, etc., etc.

You will report to me as full information as possible respecting the topographical features of the district you will traverse, having in view the opening up of the country by a trunk line or other lines of communication.

Wishing every success to the expedition,

Believe me,
Yours very truly,

SANDFORD FLEMING.

REPORT.

OTTAWA, 15 March, 1873.

To SANDFORD FLEMING, Esq.,
Engineer in Chief,
Canadian Pacific Railway.

SIR:—In accordance with the instructions conveyed to me by your letter, dated Edmonton, 27th August, 1872, I immediately made preparations for the journey indicated, and together with Mr. John Macoun, the Botanist to the exploration, left Edmonton on the 4th September for Peace River, via Assiniboine and Lesser Slave Lake. Being under the necessity of carrying with us provisions, such as flour, tea, etc., in quantity sufficient to last us through and past the Rocky Mountain Range to McLeod's Lake, I laid in the necessary stock at Edmonton, and with six pack horses and four to ride, our party, consisting of Mr. Macoun, myself and two men, set out.

Fort Assiniboine, on the Athabasca river, was reached on the 8th September, after passing over 91 miles of very fair country, of an easy character, and land partly of prairie and timber, the latter abundant from Lac la Nonne to the Athabasca.

Here I determined to cross by land to Lesser Slave Lake, and arrived there on the 24th September, after experiencing a very rough journey, having but the occasional vestige of an Indian trail, very indistinct at best, through an entirely wooded, swampy and, in places, very hilly country, utterly useless for agricultural purposes, and for a line of road excessively rough.

At this post of the Hudson's Bay Company's we changed horses, took some supplies, and started for the Forks of the Smoky and Peace rivers on the 28th September.

The soil in the vicinity of Lesser Slave Lake Post is of very good quality, vegetables of various kinds are raised, and there is luxuriant pasturage along the southern and western margin of the lake for many miles, but on that side the land is wet. From this post to Lac la Biche or Red Deer Lake, by north side of the Lesser Slave Lake, (distant in an air line say 175 miles,) the country is by all accounts thickly timbered, and not hilly, although some swamps exist.

The Peace river was reached on the 30th September, after traversing 75 miles (by account) of a very fine country generally easy and level, and of excellent soil; in great part timbered with poplar, spruce and some tamarac. Our general course was about nor' west until we struck the Peace river. Here the scene which met our view was really magnificent. Our elevation was, and had been, very little less than that of Lesser Slave Lake (Lesser Slave Lake is assumed to be 1,800 over sea level), all the distance from the latter, and the Peace river at this point rolled beneath us at a depth of some 750 feet, through a capacious valley at least two miles wide.

To south and west, its meandering course could be traced for a great distance, and a couple of miles above, on our left, the Smoky river joined it. The Heart river, which we had forded the day before but knee deep, also emptied into the Peace immediately beneath us, both of those streams flowing through immense cuts in the plateau on which we stood. A perfectly unobstructed horizon, level as that of the Ocean, stretched away to the southwest.

After enjoying the magnificent scene for a few minutes, we descended the steep valley sides, swam our horses over, (a distance of 500 yards) and camped. Next morning, after surmounting the opposite side (north) of the valley, and riding 50 or 60 miles over a level prairie, I reached Dunvegan. Here I procured a man and 7 horses (having sent back our Lesser Slave Lake animals), and after a week's delay, started by land on south side of the Peace river for Fort St. John, some 130 miles higher up. Before proceeding further, I shall make an extract from my diary relative to the country and climate about Dunvegan.

Fort Dunvegan is situated on the north side of the Peace river, upon a level terrace 30 feet above mean river level. The height of the country behind, and around Dunvegan, is about 700 feet over the river, which here, has an altitude of about 900 feet above the sea. This altitude was obtained from a set of barometric readings extending over 8 days. From the Rocky mountain portage down to the Smoky river, (a distance say of 250 miles,) the Peace river flows through a depression in the country, ranging in depth from 800 to 600 feet. The underlying formation is limestone, and the whole of this region appears to be composed of an immense layer of clay and alluvial soil, resting upon a horizontal bed of that material. Sandstone is also found in large quantities, and grindstones of excellent grit are to be found in the river bed.

The north side of the Peace river, between the portage and the Smoky river, is generally level, and partially prairie for some distance back, but cut up here and there by the deep beds of numerous tributaries. From Smoky river upwards, on the south side, to about opposite Dunvegan, the country has much the same appearance, with perhaps more open country, but from this point it gradually becomes more thickly timbered and rougher, and maintains this character up to the Rocky mountain portage. Several tributaries occur on this side all flowing through very deep beds which offer serious obstructions to roads, but those river valleys gradually lose their depth on nearing the prairie country which lies 20 or 30 miles south, and which extends from Smoky river right up to the Rocky mountain range. The climate of this region and of the Peace valley generally is, somewhat similar to that of Red River, but the extremes of heat and cold are not so great, and the climate is tempered by the westerly winds which here prevail, and are mild. Snow rarely reaches. and seldom exceeds, a depth of 2 feet, and does not pack. The climate is dry and salubrious. As to the fertility and excellence of the soil, there is not the least doubt. The few residents of Dunvegan do not practise agriculture to any extent, but there can be no doubt that, if good seed were used, and proper means employed, fair crops of potatoes, barley, &c., and fall wheat would result. The one or two residents content themselves with raising a few potatoes, and for those the same seed has been in use for the last 20 years. At Fort St. John however, we found some excellent vegetables, which it would be hard to beat in size and quality. Horses and cattle thrive remarkably well at Dunvegan. Mr. Macoun, the botanist, during our stay at this place, made a thorough investigation as to the climate, &c., and no doubt his report has already reached you.

The Peace river, from the Rocky Mountain portage downwards to the point where we struck it, is admirably suited for steamers of large tonnage, there being plenty of water, and its width ranging from 600 yards at Smoky river to 200 yards below the Mountain portage.

We arrived at Fort St. John on the 17th October, distant from Dunvegan by our trail, and by account, 115 miles.

Our trail passed from 10 to 20 miles, I should judge, to south of the Peace river, and several good sized tributaries of the latter were crossed. Some of the country along this route was really very fine, partly prairie and partly dense timber, the timbered portion was, generally speaking, rough. The soil, in every instance, was excellent, and vegetation vigorous. Fine spruce, poplar, birch, etc., in profusion. All this country is fit for settlement. An excellent coal was found not far from Dunvegan, and I believe that mineral underlies the whole country.

Just before reaching the Epinette river, which empties into the Peace River about 5 miles below Fort St. John, (and one of whose branches flows from the Summit lake, I shall presently bring under your notice,) the country becomes very rough, the valley of this stream is excessively deep, and runs back for a long distance towards the Rocky Mountains, and from this point up to the portage, the right bank of the Peace is very high, rough, and densely wooded. This piece of country would present very serious engineering difficulties to any road approaching the Peace river valley pass from the east.

Immediately on my arrival at Fort St. John, I engaged four Indians to proceed with me up the valley of the Epinette and across the Rocky Mountains by a pass used by the Beaver and other Indians to McLeod lake. They, however, after our arrangements were made, refused to proceed, being afraid of the difficulties which we would surely have had to encounter at that late season. I, therefore, determined to proceed round to McLeod lake by the Peace river, and arrangements were made accordingly. Before going further, I shall give the Indian account of this pass: One of the branches of the Epinette takes its rise in a small lake situated on the summit of the Rocky Mountains. Another stream flows weswardly from the same lake and enters the Parsnip, or south branch of the Peace, a little distance above McLeod's river. This stream is said to have in many places, little current, and to flow through a wide valley with good level benches. In the spring of the year, when the crust is good, Indians walk from McLeod's lake to Hudson's Hope in four days, up this river, past the Summit lake, and down the Epinette. Now, assuming the height of the Parsnip to be 1800 feet at entrance to McLeod river, and putting the length of this westerly flowing stream at 70 miles, (which is an ample allowance) and giving it a rapid and strong current, we can safely put the altitude of this Summit lake at 2,500 feet. From all accounts, I believe, the country between this point on the Parsnip and Quesnel on the Frazer, to west of the latter, will be found quite practicable for a line. Again, the prairie country on the eastern side approaches quite close to the Summit lake—there might perhaps be 20 or 30 miles of rough and wooded country intervening. The general altitude of the country on the east side of the Rocky Mountains and about the portage must be about 1800 feet. This quite agrees with the Indian reports, which represent the rise from the east towards this pass as very gentle. All this informatian I have obtained from Indians, and I feel convinced that at any rate the subject is worthy of fuller investigation. A comparison of the two approaches to the Rocky Mountains from the east, viz., between the Jasper House route, and one passing Lesser Slave lake post, crossing Smoky river and traversing the beautiful country I have already briefly referred to, would be greatly in favor of the latter. I have seen the former and know it to be of not great worth for settlement, whereas the Peace river route would traverse a country finer than any between Red River and Edmonton, not to mention the actual engineering difficulties which, I am confident, would be verv much lessened.

Having thus as briefly as possible touched upon those matters, I shall now resume my trip from Fort St. John up to McLeod's Lake.

On the 19th October, we started for the Rocky mountain portage and reached the head on the 22nd. There we were lucky enough to find a boat, the loan of which we obtained from some miners, and started for McLeod's Lake on the 24th.

The difference in level between the foot and head of the Rocky mountain portage is, I should say, between 200 and 300 feet. The river here flows through the outer range or foot hills, and its course from the upper to the lower end of the canyon is nearly semi-circular and about 30 miles round, while the portage road is only say 14 miles across. At the head, the river rushes through a rocky and deep chasm 100 yards wide, but immediately above, the stream widens out to perhaps 200 or 300 yards.

We experienced a very strong current all the way up to the Finlay Branch (70 miles), and encountered two rapids or falls. From the head of the portage to within a few miles of the Finlay, the Peace flows through the entire Rocky mountain range. For 30 to 40 miles from the head of the Rocky mountain canyon, the valley is encompassed by mountains of not very great altitude, but a little east of the " Rapide qui ne parle pas," the main range begins, and the river flows through it for about 25 miles, and until within a few miles of the Finlay branch, and within this distance, peaks 4,000 and 5,000 feet above the eye, extend back both north and south as far as visible.

The banks within this valley are very rugged, there are gravelly terraces here and there, but steep and projecting rocky points occur at frequent intervals, and in many places the mountains rise up sheer from the river, necessitating, in the case of a road, many deviations and heavy works of construction.

During my stay here, I made enquiry about the country lying south of the Nation lakes, and in a line from McLeod's lake towards the Babine Fort, and to south of lake Tacla. I was informed that it is passably level, and from all accounts, could be made available for a road as far as a point upon Babine lake opposite the Hudson's Bay Company's Fort.

I then started from Stewart's lake on foot on the 2nd December with three men, packing our provisions and baggage, *en route* for Babine Fort, where I arrived on the 11th, having had extreme difficulty in getting round Stewart's lake, which was only partially frozen, and having passed over a very rough and mountainous country, and to all appearance very barren.

From lake Trembleur to the Big Bay on Babine lake, there is a very fair and level piece of country, through which Gus Wright's trail runs—with this exception, the rest was mountainous and impracticable.

From the point opposite Babine Fort, I followed the country to north east of Babine lake, and struck the lake at the village. All this distance I found quite practicable and not hilly. I estimate the height of lake Babine to be eighteen hundred feet above the sea.

At the village here there is a good crossing not over 100 yards wide, banks low, and gravelly bottom.

I here struck westwards for the Forks of Skeena, distant about 55 miles. I followed the miners' horse trail, which, at a distance of nine or ten miles from the village, crosses the summit of a mountain range extending along the western side of lake Babine and north to the Babine river. The horse trail crosses the summit at an elevation above the lake of about 2,400 feet, but immediately to south of the horse trail is a level swamp 800 feet lower, out of which flows a little stream easterly into Babine lake, and another (the Susqua,) westerly into the Watsonqua, a tributary of the Skeena.

The ascent from Babine lake to this summit muskeg would be steep (1600 feet in nine miles) and difficult, the river would have to be followed in a great measure. Its bed is narrow and the banks steep and rocky on south side. On the summit, the snow was three feet deep. The westerly descent down the valley of the Susqua from this summit, and for the first few miles would be easy, but after that, the river flows through a deep and rocky gully (river 10 to 15 yards wide) with steep sides. Here a line would have to leave the river margin and take to the higher slopes, which are very uneven, and where considerable cutting, numerous small bridges over the lateral gullies, and very heavy grades, would be required.

This rough and expensive work would be necessary for a distance of say 12 or 14 miles, when the valley takes a sudden dip of 600 feet in two miles. The valley is wide enough at this point to admit of gradients.

The Susqua river margin, on right bank, might again be followed, *and with ease* for several miles, when it would be necessary to cross to its left bank, and follow it down with ascending grades at first, and skirt the southern slope of the valley for a mile or so, then re-cross, (the Susqua here is not over 30 or 40 yards wide) pass over a couple of miles of level country, cutting off the angle formed by the junction of the Susqua with the Watsonqua, cross the latter a mile or so below the confluence to its left bank (crossing 70 yards wide, banks 60 feet high good level benches.

Altitude of bench at crossing, say between 900 and 1000 feet above the sea) then intersect the Western Union Telegraph trail, and rise to general level of the wide and high level benches which lie at the base of the "Rocher deboulé" range. This last rise would require 90 feet grades at least for three miles.

After gaining this level, 25 miles or so of a good line would be obtained round the base of the Rocher deboulé and down the left bank of the Skeena to the Indian village of Kitsigeuchlé—here there is an excellent crossing.

Before going further, I may remark that the line I have just pointed out, viz., that from the Babine village, and down the Susqua valley, to the benches under the Rocher deboulé, is the only available one in this direction, there being a complete mountain barrier all along the western side of Babine lake, in fact all the distance from Stewart's lake; and in a northerly direction the Babine river valley is reported as rough in the extreme.

This distance then (between the Babine village and the forks of Skeena), of say 60 miles would involve very steep gradients between the Babine lake and the summit, perhaps heavier than practicable; while the descent westwards would necessitate, at least, 20 miles of the most expensive railway work, in the shape of heavy grades, deep cutting, and frequent small bridges.

You will now observe that I have carried my description to a point whence a line can be taken, either down the Skeena to the sea, or across to the Nasse river.

I must here remark that after making extensive inquiry regarding the valley of the Skeena, I arrived at a conclusion entirely adverse to its practicability as a route.

It was described to me as excessively rough, especially in that part of its course where it passes through the Cascade range. Precipices of immense height immediately overhanging the river, and without any possibility of getting behind them, were spoken of, and altogether, I heard enough to satisfy myself that a journey down that river would have been fruitless.

Another drawback to the Skeena route is that the harbor is bad, the water being shoal, so I am told, and in the fall of the year the ice comes down in huge floes, very dangerous to vessels lying at anchor.

Besides, the whole country about Port Essington is so rough and mountainous, and there is so little land available for a town site, that the Skeena route may be safely dismissed from further consideration.

I may say further, that a trip from the Forks down the Skeena, at that season, would have involved considerable expense and risk, besides loss of time. I should have been obliegd to haul a canoe with me the entire distance, as the river was only partially frozen, and the ice very dangerous in many places. I therefore decided upon striking the coast at the Nasse harbour, having heard favourable reports about the country lying between the Forks of Skeena and that river.

I accordingly left the Forks on the 4th January with 4 Indians, all of us on foot as usual, the men packing our supplies.

We followed down the Skeena to Kitsigeuchlé, the point to which I have already carried my description, and still keeping the river for four miles, left it, and struck northwards up the Kitwangar river to its source, passed the Indian village of Kitwancole, and followed down the Chian-howan river to its confluence with the Nasse river. The latter we followed, sometimes on the ice, and sometimes on the benches, and reached the Indian village of Kitlatamox on the 14th.

McNeil's store, a little below tide water, and distant from the Forks of Skeena say 160 miles, was reached on the 17th. Here I had some difficulty in obtaining Indians to take me to Fort Simpson, a point on the sea coast situated some 40 miles to south and west.

After some delay I obtained a Northern canoe and crew, and after hauling the former some half dozen miles on the ice to open water, we reached Port Simpson on the 23rd January, where I was most kindly welcomed by Mr. Morrison of the Hudson's Bay Company. Here I waited eight days, when, by great good luck, the Hudson's Bay Company steamer "Otter," Capt. Lewis, made her appearance on a trading voyage.

I embarked on the 31st January, and after compulsorily visiting the Queen Charlotte Islands, the Coast of Alaska, Bella Bella, Bellacoula (up the Bentinck North Arm), Fort Rupert, Comox and Nanaimo, I reached Victoria on the 12th February, having experienced some very stormy weather.

Finding that the "Prince Alfred" had left, I took the route *via* Olympia and Portland, and reached San Francisco on the 24th.

I shall now briefly describe the country passed over, from the Village of Kitsigeuchlé to the Nasse Harbour.

I remarked before that a good and favorable crossing of the Skeena could be made just below that village to its right bank. (A bridge probably sixty feet high and not over 600 feet in length would suffice here.)

A level of six hundred feet over the river would then have to be attained, and a rolling and somewhat rough country crossed for a distance of about fifteen miles, when a line would take the upper part of the Kitwangar Valley.

From this point up to Kitwuncole Lake (probably not over 1,000 feet above the sea), and down the Chian-howan Valley, to within half a dozen miles of the Nasse River, a line would be perfectly easy and of gentle grades. It would follow a beautiful and level valley, half mile to one mile wide, for all that distance: say fifty miles.

The line would then leave the Chian-howan Valley and pass over about thirty miles of the country lying east of the Nasse River.

I did not pass over this last mentioned piece of ground, but had an elevated view of it from a distance, and it certainly did not appear mountainous or difficult.

The last thirty miles being passed over, the Nasse River could be followed along the low and level benches, which are to be found all the way from a point a little below Kitlatamox to an Indian village (Kitâwn) situated some ten or twelve miles above Salmon Cove.

From Kitâwn to Salmon Cove some rock cutting would be necessary along the left bank of the river, and the margin of Salmon Cove could, I think, be reached by a narrow defile through the mountains, two miles in length.

The Salmon Cove is three miles long by one mile wide, and is sheltered from seaward. It has very fair anchorage, but vessels lying there would be exposed to the terrific north-easters which blow right down the Nasse River.

Captain Lewis, a gentleman of great experience upon the coast, pronounces the Nasse Harbour to be unsafe on that account. With the exception of this drawback, and the fact of their being but one little piece of level land (situated on the west side of the defile I have just mentioned) available, this harbour may be considered good. It can be approached from seaward by steamers at any time, but sailing vessels would experience great difficulty getting in during the prevalence of north-easterly gales, and there is no anchorage outside, the water being very deep.

Upon the whole, the Nasse River would be a very undesirable terminus for a trunk line, but, in the event of the Peace River Mines turning out well, a waggon road may eventually pass that way.

I furnish herewith a chart of the Nasse Harbour, showing the soundings, etc.

As for the country I passed over, from Fort St. James to the seaboard, I may, with the exception of a few little spots here and there, safely pronounce it as utterly worthless for agricultural purposes.

At the Forks of Skeena there is some very fine land, however, and I believe also at Kyspyox.

Along the Kitwangar and Chian-howan valleys one meets with some very good arable land, but, generally speaking, the country traversed by me was mountainous and rugged, and only valuable for the minerals it may contain.

This fact alone, apart from engineering difficulties (which are not very great in the case of a route by the Nasse), renders it desirable that a trunk line be carried further south, and strike the coast at some other point than either the Nasse River or Port Essington.

During my voyage from Port Simpson (a very good harbour) to Victoria, I had an excellent opportunity to see the whole coast line as far as Cape Caution.

Nearly all the harbours from Port Essington to that point are situated up long and deep inlets, almost invariably walled in by high and precipitous mountains.

Up and down those inlets the winds blow with terrific violence, more especially during the winter season, and sailing ships would often find it impossible to go up or down with adverse winds. Steamers, of course, could always make headway, but still occasionally with difficulty.

Bellacoula, a post of the Hudson's Bay Company, situated at the extremity of the Bentinck North Arm, offers, I believe, an outlet through the Cascades from the interior to the coast.

From accounts of the route by parties familiar with the locality, I am inclined to think that a road from Alexandria, on the Frazer River, to Bellacoula could be made without very great difficulty. Pack animals, I have been told, have made the trip between those points in ten days.

Be this as it may, the valley here is very narrow, and surrounded by high mountains, and is, besides, subject to flood. The anchorage is also bad.

Half a mile from the shore the water is excessively shallow, in fact the shoal dries at low water, and then it suddenly deepens to twenty-five and thirty fathoms, while a little farther out 150 to 200 fathoms of water are found.

Where we anchored (about a mile from shore) the inlet was perhaps a mile and a half wide, with very high mountains on each side. Bellacoula is fully eighty miles from the entrance of Fitzhugh Sound, and from the beginning of Buurke Channel upwards, the inlet varies in width from one and a half to two miles.

Ships from the offing require to exercise caution in approaching the entrance to Fitzhugh Sound, owing to the sunken rocks. The dangers are, however, well laid down in Captain Pender's Coast Charts.

The navigation of the entire British Columbian coast, from Fitzhugh Sound up to Alaska, is difficult for sailing vessels, owing to the numerous islands, and narrow, intricate channels.

Steamers knowing the coast well would not have the slightest difficulty, but strangers making the land at any point north of Vancouver Island for the first time would incur risks, from which they would be comparatively free in approaching the southern ports of British Columbia.

Agreeably to your instructions, I made enquiries as to the snow fall and climatic influences, which obtain on the Peace river and on the western slopes of the Rocky Mountains.

Regarding the depth of snow on the prairies and open country situated east of the Rocky Moutains, and on each side of the Peace river, I think that the greatest depth ever attained will not exceed two and a half feet; the average is about two feet, but it occasionally happens that the ground is bare even up to the month of December.

I believe we can safely count the maximum snow fall between Lesser Slave Lake and the base of the Rocky Mountains to be two and a half feet, unless in places where drifts might occur.

Between the Rocky Mountain Portage and the Finlay Branch, in the *Valley of the Peace River*, a depth of three feet would, I think, be rarely exceeded along the terraces and beaches.

At McLeod Lake, snow often lies to a depth of four feet, but between that point and the Pine Summit Lake, all is yet conjecture, although in a former paragraph, I have mentioned a depth of ten feet as probably occurring there.

A very important feature in connection with the snow fall *East* of the Rocky Mountain range is its dryness: snow rarely packs, it powders, and becomes crisp; the dry state of the atmosphere East of the range causes this.

At Stewart Lake, I believe, two feet or thereabouts, to be the average snow depth.

I shall now close this report by expressing my thanks to the Hudson's Bay Company, to whose officers I am universally indebted for prompt assistance and hospitality extended to me at every post which I passed in the course of this long and arduous journey.

I have the honor to be, sir,
Your obedient servant,

C. HORETZKY.

APPENDIX C.

Report by John Macoun, Esq., M. A., Botanist to Mr. Fleming's Expedition from Lake Superior to the Pacific Ocean.

BELLEVILLE, May 1st, 1873.

SANDFORD FLEMING, ESQ.:

DEAR SIR,—Having been requested by you to accompany your Expedition across the continent as Botanist, with the view of making a collection of plants and ascertaining from the Flora of the country the capabilities which different sections of it might possess for agricultural pursuits or settlement, I joined your Expedition about the third week in July last on Lake Superior; and travelled in your company to Fort Garry and Edmonton. At the latter place I received your special instructions to proceed on a branch expedition, by way of Peace River, to the Pacific Coast.

I reached the Coast of British Columbia on the 12th Dec.; took the speediest means of conveyance to San Francisco, and from thence, by rail, arrived at Ottawa on the 8th January last.

It now becomes my duty to report the botanical facts I was enabled to accumulate on the expedition, the deductions which I have drawn from them, and such impressions as I may have formed respecting the country which I have travelled over.

It will be convenient to divide this report into two sections, embracing:

SECTION I.—*Observations on the country from Lake Superior to the North Saskatchewan.*

(1) Thunder Bay to Manitoba.
(2) Manitoba to Edmonton.

SECTION II.—*From the North Saskatchewan, via Peace River, to British Columbia, embracing*:

(1) Topography of the country.
(2) Geology and Minerals.
(3) Botany of the region traversed.
(4) Climate, soil, and suitability for settlement.
(5) Facilities for lines of communication.

SECTION I.—LAKE SUPERIOR TO THE NORTH SASKATCHEWAN

THUNDER BAY TO MANITOBA.

Having spent the greater part of a month in the year 1869 botanizing on the shores of Lake Superior, and up the Kaministiquia, I cannot let the present opportunity pass without recording a few of the observations made at that time.

An opinion has gone abroad that the lands around Thunder Bay and up the Kaministiquia are unfit for settlement, owing to the extreme cold and summer frosts of that region. That this opinion is erroneous can be easily seen by a careful perusal of the following paragraphs.

Early in the year 1869, G. F. Matthews, Esq., of St. John, New Brunswick, read a paper on the occurrence of Arctic and Western plants in Continental Acadia. Amongst other valuable information, he showed that the Mean Annual Summer Temperature of St. John, N. B., Thunder Bay, Halifax and Toronto, was as follows:

	May.	June.	July.	Aug.	Sept.	Oct.	Mean Sum.
St. John, N. B.	47.3	54.5	59.7	60.0	55.0	45.7	58.1
Thunder Bay	48.9	58.7	62.2	53.8	48.2	41.9	59.9
Halifax	48.0	56.3	62.3	63.7	57.0	47.0	60.8
Toronto	51.5	61.0	66.3	65.7	57.4	45.0	64.3

In July of the same year, I made large collections around Thunder Bay, and up the Kaministiquia, detecting many sub-arctic and boreal forms close to the waters of the lake, but none two miles up the river. The cause of this was evident; almost constant rains and fogs prevail around the Bay during the hot months, lowering the temperature and giving a climate, almost analogous to that of Halifax or St. John along the shore of the lake, but with a far higher temperature as we go inland from any point on it.

The vegetation around Lake Superior is noted for its luxuriance. All herbaceous plants have a tendency to increase beyond their normal size along the west side of the lake, and American botanists report the same from the south side. The only cause that can be assigned for this is the humid atmosphere combined with a sufficiency of heat to develop, at least the leaves and stems of the plants.

Leaving the low marshy flats at the mouth of the Kaministiquia, and ascending the river, a botanist is soon struck with the change in the aspect of the plants he passes.

All the sub-arctic species with which the shores of the lake are fringed, disappear; many of the boreal forms become very scarce, and by the time the mission (1½ miles from Thunder Bay) is passed, almost a complete change has taken place in the vegetation. As he proceeds up the river roses (*Rose blanda*) begin to appear—a sure indication of a dryer soil. By the time two miles are passed, black ash (*Fraxinus sambucifolia*) shows on the banks, and the undergrowth becomes almost identical with that of the rear of Hastings and Frontenac, on the shore of Lake Ontario. A few miles further, and forms peculiar to a dry soil begin to take the place of those seen farther down, while the alluvial flats along the river support a most luxuriant growth of just such plants as would be seen on any river bottom in Eastern or Central Canada. Thickets of wild plum (*Prunus Americana*) three or four different cherries, gooseberries, currants, raspberries and strawberries grow in profusion, interspersed with various species of Viburnum and other Caprifoliaceous plants. The herbaceous ones were very numerous and luxuriant, and these, including the wild peas (*Lathyrus venosus et ochroleucus*), the vetch (*Vicia Americana*), caused such tangled thickets that it was almost an impossibility to force one's way through them. Wild hops (*Humulus Lupulus*) climbed up almost every tree, and John McIntyre, Esq., in charge of Fort William, told me they produced excellent hops.

For the whole distance up to Kakabeka Falls there was a constant influx, of new species, having a western tendency. Between Kakabeka Falls and the mouth of the river, I detected 315 species, all of these being natives of Hastings, except eighteen species, viz.:

Alnus viridis,
Negundo aceroides,
Rubus Nutkanus,
Lonicera involucrata,
Mertensia paniculata,
Phacelia Franklinii,
Nabalus racemosus,
Humulus Lupulus,
Hordeum jubatum,

Comandra livida,
Ranunculus Cymbalaria,
Lathyrus venosus,
Oenothera chrysantha,
Vicia Americana,
Woodsia glabella,
Botrychium simplex,
Vaccinium Vitis—Idœa,
Carex flexilis.

I could see nothing in the flora to lead me to doubt the feasibility of raising all the cereals in the valley of the Kaministiquia—a valley said by Professor Hind to contain an area of more than 20,000 acres, exclusive of the Indian reservations. The soil is apparently of excellent quality, and has much the appearance of the river bottom of the west.

A cursory glance was all that was allowed at Prince Arthur's Landing, but this sufficed to show that in three short years a thriving village had sprung up, where not a house had stood in the spring of 1869.

A delightful ride of 45 miles over the Dawson Road brought us to Lake Shebandowan. Only two years ago this road was pronounced a myth, now it is not only passable, but for many miles as good as the generality of Canadian roads.

After we ascended the hill and got out of the influence of the cold air from the lake, all the vegetable forms, which delight in a cool damp atmosphere, took their leave. As we advanced into the country, the soil improved with a corresponding change in its productions. At the Matawin, vegetables of every description were growing luxuriantly, but more especially timothy hay (*Phleum pratense*) which seems to be peculiarly suited to the regions around Thunder Bay. Many of the stalks were four feet in length, with heads fully eight inches long. After passing the Matawin, the soil changes to a reddish clay, but there is no change in the vegetation. The flora of the whole region indicates a moist climate, with a sufficiency of warmth to bring seeds in all cases to perfection. When the country becomes cleared up—which it will be in a few years—either by accidental fires, or by those of the settler, a marked change will take place in the climate. It will become drier, and all kinds of grain will ripen much earlier. Coniferous trees, with a thick coating of moss, cover the greater part of the country; when these are gone, a new crop of trees will spring up, but they will be deciduous ones, and the country will probably be less moist and warmer.

There is no land fit for cultivation on Lake Shebandowan. Scattered red and white pines dot the landscape, but the principal forest growth is birch (*Betula papyracea*), aspen, (*P. tremuloides*) and scrub pine (*Pinus Banksiana*). The Height of Land Portage is very wet, and so is the land bordering on Lac Mille Lac. A continuous forest of spruce, balsam, aspen, and birch, with a sprinkling of red and white pine, and occasional groves of Banksian pine, surrounds the lake. Pine was only observed close to the shore and on the islands.

Baril lake has much the appearance of the preceding one. After passing it, however, the country begins to change and by the time we are three miles down Lake Windergoostegon, large groves of Banksian pine mixed with red and white ones are constantly meeting the eye. In a short time these become continuous and the forest takes the appearance of the pine lands of Ontario. On the portage between the above and Blackstone lake, the trees are principally aspen and Banksian pine, both attaining considerable size. On the west side, the portage terminates in a beautiful grove of red pine of some extent. Here the hazel nut (*Corylus rostrata*) and the red ash (*Fraxinus pubescens*) first appear west of the height of land.

After passing through a small lake, we enter a river and for the next mile or two follow its tortuous windings. Shortly after, we pass the residence of chief Blackstone, situated on a small bay, in a very extensive grove of red pine. Soon after the shores get bolder and the country has the appearance of a drier region than any we have passed through since leaving Shebandowan. Pines have taken the place of spruce, and are the chief objects in the landscape. Pine Portage, our next stopping place, is very appropriately named. Here red and white pine attain a large size, many of them being over three feet in diameter.

Residents on the portage say there are large areas of good land in the vicinity; and that red and white pine are abundant and of good size.

This region seems to have many of the characteristics of the country lying in the northern parts of Hastings, Peterboro', and Victoria. It seems to be more like a lake studded with islands than a country interspersed with lakes. Much good timber will yet be taken from this lake region.

From here to Rainy lake, the country is a constant succession of lakes, rivers, marshes, swamps, rocky hills and low grounds. Fully half the surface is water or marsh. Little of the pine is fit for the saw mill, but immense quantities of railway ties could be obtained. The shores of

Rainy lake present a most dreary and uninviting appearance. Most of the islands are low and rocky, and have little soil on them. At their western end many large boulders were seen, a sure indication of the action of moving ice. As we neared the western end of the lake the banks became higher, but the forest growth still retained its stunted character. Many islands, beautifully rounded in outline, were passed, but very few of them fit for cultivation. The approach to Fort Francis is very beautiful. As we approach the outlet of the lake and enter Rainy river, the right bank appears very much like a gentleman's park, the trees standing far apart and having the rounded tops of those seen in open grounds.

Blue Oak (*Quercus Prinos var. discolor*) and Balsam Poplar (*Populus balsamifera*) with a few aspen are the principal forest trees. These line the bank, and for two miles after leaving the lake we glide down between walls of living green until we reach the fort, which is beautifully situated on the right bank of Rainy river, immediately below the falls. All sorts of grain can be raised here as well as all kinds of garden vegetables; little attention is given to agriculture, but enough was seen to show that nature would do her part if properly assisted. Barley three feet high, and oats over that, showed there was nothing in the climate or soil to prevent a luxuriant growth. In the rear of the fort the land is wet, but could easily be drained as the fort stands over 30 feet above the river.

Rainy River deserves more than a passing glance, both for its beauty and its adaptability to the purposes of commerce. With the exception of the "Grand Falls," the Long Sault and the Manitou Rapids, there is not an obstruction to navigation in the whole course of the river. From Fort Francis to the Lake of the Woods, and through it to the North West Angle, is, with the exception of the two rapids above referred to, which, it is hoped, a powerful steamboat may overcome, one continuous stretch of steamboat travel. At Fort Francis two large and powerful steamboats are being built, one above and the other below the "Great Falls;" the former for the navigation of Rainy Lake, the latter for the river and Lake of the Woods.

The length of the river is about eighty miles It forms the boundary between the Canadian and United States territories. The right, or Canadian, bank for the whole distance is covered with a heavy growth of forest trees, shrubs, climbing vines and beautiful flowers. The Indians say that the good land extends back from the river a distance of from two to twenty miles, and that the timber gets larger as you proceed inland. The forest trees consist of oak, elm, ash, birch, basswood, balsam, spruce, aspen, balsam poplar, and white and red pines near the Lake of the Woods.

The whole flora of this region indicates a climate very like that of Central Canada, and the luxuriance of the vegetation shows that the soil is of the very best quality. Wild peas (*Lathyrus venosus*) and vetches (*Vicia Americana*) were in the greatest profusion; the average height was about six feet, but many specimens were obtained of eight feet and upwards While the boat was wooding up I took a stroll inland and found progress almost impossible, owing to the astonishing growth of herbaceous plants. The following plants were observed on Rainy River while dinner was being prepared, and are only an index to the vast profusion of nature's beauties in this region :—

Lilium Canadense,
" Philadelphicum,
Vicia Americana,
Calystegia spithamea,
" sepium,
Aralia hispida,
Lobelia Kalmii,
Smilacina stellata,
Lathyrus venosus,
" ochroleucus,
Monarda fistulosa,
Viburnum pubescens,
Astragalus Canadensis,
Erysimum chieranthoides,
Asarum Canadensis,
Lopanthus anistatus.

Besides these there were grasses and sedges in abundance and many other species not worth mentioning. Enough was seen, however, to satisfy the writer that Rainy River will yet support a large population, mainly composed of agriculturists.

It is unnecessary for me to make any remarks on the country between the North West Angle and Point Du Chein, as it has been so frequently noticed in connection with Manitoba Suffice it to say that near the lake the land, generally, is low and swampy, but as we proceed westward from the lake it gradually rises, becomes drier, and eventually passes into prairie at Oak Point, the first settlement in the Province of Manitoba.

MANITOBA TO EDMONTON.

Manitoba has been the subject of so many reports that anything further from me appears unnecessary. Still there are a few observations which I would desire to record. It is generally supposed that the land producing saline plants lies far to the west of Fort Garry. This is a mistake, as within less than two miles of the Fort I detected a species of Samphire (*Salicornia herbacea*) and Glasswort (*Chenopodina maritima*), and a few other plants peculiar to a saline soil, but not so characteristic as the above. These were all found in shallow depressions of the prairie, where the water did not run off but was evaporated by the sun. Now, by applying these observations as we proceeded westward, it was very easy to predicate where we would find fresh water, as in all cases where there was no outlet (except in the case of springs) the water was brackish.

In Manitoba this will soon be remedied—drains will be cut to take off the surface water, trees planted, and as a consequence a greater rainfall; the salts will be dissolved and carried off from the surface, and salt-plants disappear. This is no fancy sketch, as it is a fixed fact in Physical Geography that to clothe the land with trees takes away the salt and gives a greater rainfall. Any person acquainted with the history of Palestine and Northern Africa knows that what were the most fruitful countries in the world 2,000 years ago are now barren, saline wastes. The cause is well known, the trees were cut down, none were planted in their place, the sun evaporated the rain before it had time to permeate the soil, salts accumulated, and in course of time the land was given up to perpetual barrenness.

Our interior plains will yet be covered with wood, there will be a sufficient rainfall, streams will be more frequent, the old channels will contain more water, brackish pools will give place to purer waters, and the teeming millions will only know by tradition or old records that the land was once given up to the red man or the buffalo.

To a common observer these matters are not so plain as they are to a botanist. A botanist is struck with the absence of mosses, and asks himself the cause. The answer comes at once. Moisture is evaporated too quickly. How shall we prevent this? Cover the land with trees, *by stopping the annual fires.* Three-fourths of our prairie is within the line of natural forest. The home of the Aspen in Canada is on dry, sandy or gravelly hills. The aspen is the sole forest timber of our interior plains, and was seen at intervals all the way across to Edmonton. Were the fires stopped most of the land would soon be covered with aspen and willows,—the former on the drier grounds, the latter in the marshy spots.

Many ask how it can be possible that Manitoba can be warmer than Minnesota, but they never consider that much of the latter State is 1,500 feet above the sea, while the former is not half so much. Lake Winnipeg is only 31 feet higher than Rice Lake, which is only 15 miles to the north of Lake Ontario. Much of the Province of Ontario lies far higher than Manitoba, and the summer heat of the one is fully equal to that of the other. It is never necessary to speak of winter temperatures in connection with the raising of cereals, as the ripening of seeds depends altogether on the heat of summer.

After a short stay at Fort Garry we proceeded westward through a beautiful country to Portage la Prairie, and without halting kept on to Rat Creek, the boundary of the "Great Lone Land." Before reaching the Creek we were caught in a thunder storm, which had a marked effect in damping our botanical ardor.

After passing Rat creek the trail led over a wide prairie, which extended far as the eye could reach, and covered with a profusion of beautiful flowers. For the first few miles the country was an unbroken plain, studded at intervals with clumps of small aspen. As we proceeded it became more thickly covered with aspen clumps, and gradually changed from a boundless prairie to a partially wooded plain. The trees were quite small—in no case being more than six inches in diameter. Constant fires are certainly the cause of the want of wood. After leaving the creek we passed through a tract of land well suited for cultivation, but the last ten miles seem to be quite wet in the spring, and had many thickets of willows and other shrubs thickly scattered over its surface. For the next two miles the trail winds along the base of a range of low sand hills, and then over an undulating country, which seemed like the old settled parts of Canada, without houses or fences. This is the first rough land since leaving Fort Garry—a distance of nearly 100 miles. The Riding mountains lie a little to the northwest of us, and there, together with the hills and rough country, indicate that we are about to ascend to the second prairie steppe. From Point du Chein (Oak Point) 30 miles east of Fort Garry to this point, making a distance of 125 miles from east to west, and extending from the forty-ninth parallel on the south to lakes Winnipeg and Manitoba, on the north, stretches a region of country, not to be excelled for the raising of cereals by any other tract of the same size in America.

For eight miles the trail led through a rich country, vegetation of every kind most luxuriant. The whole of this region was evidently covered with forest at no recent date, as there are still oaks and many aspens remaining. Fires are gradually denuding the whole country of wood, as the margins of all groves show the action of fires. Passing out of this, we came to a region of sand dunes. Here we observed the first coniferous trees seen since leaving Oak Point. White spruce, (*Abies alba*) common juniper, (*juniper communis*) and the creeping variety (*J. Sabina var. procumbens*) were abundant, and underneath their shade grew many of the flowers of the pine woods of Canada. Pine creek, a small stream, winds amongst those hills which stretch for about four miles on either side of the stream Gradually the hills melted into the plain, and a wide dry prairie extending for miles spreads out before us. The soil is well suited for cultivation, but wood is very scarce. About the centre of this prairie we crossed Boggy creek, and six miles beyond came to a gravelly tract thickly strewn with boulders. For 21 miles the surface of the country is much diversified by ponds, lakelets, small groves of aspen, and thickets of willows, with broad, dry expanses of prairie, covered with grass and flowers. Since we struck the hill, we have been gradually rising higher and higher, and the vegetation shows a drier climate. We are now on the banks of the Little Saskatchewan, which runs in a valley about 200 feet deep; evidently scooped out of the drift by its own waters. The leading characteristics of the vegetation remain unbroken. On low spots sedge grass (*Carex*) mixed with wheat grass (*Triticum*), cord grass (*Spartina*), and various species of blue joint (*Calamagrostis*). On dry grounds the grasses are various species of Vilfa, Sporobolus and Stipa, with a few others in less abundance. The chief flowering plants are wild bergamot (*Monarda fistulosa*), various Sunflowers (*Helianthus*), Cone flowers (*Rudbeckia trifida*), Golden Rods (*Solidago*) and a multitude of Asters, Petalostemons, Lupinus, Oxytropus, Hedysarum, and many fine species of Astragalus with other Leguminous and Rosaceous plants.

The valley of the river is very beautiful and formed a pleasing contrast to the monotonous country passed over before reaching it. The timber on its banks is nearly all destroyed by the recklessness of travellers. In a few years there will not be a tree left in the country. From the river, the country still kept ascending, ridge after ridge coming into view until at last we reached the level of the steppe. Before reaching this the vegetation showed a considerable retardation, owing to the want of heat and moisture; except this, there was no change. We camped for the night at the Salt lakes, which are in a slight depression, off the general level of the plateau. The shores of the lakes produce many saline plants, of which the following are the principal:—*Scirpus maritimus L. Salicornia herbacea, L. Glaux maritima, L. Suada maritima, Dumot, var prostrata, Pall. Glyceria distans*, these have a wide range over the whole interior wherever salt lakes are found.

For the next sixteen miles the trail leads over the plateau. In it were many depressions containing depositions of saline matter, and a few lakelets we passed were evidently saline. The surface water of this region, in summer, is certainly unfit for use without being filtered.

After passing over the plateau we came to the Shallow lakes—beautiful sheets of pure sweet water—with their discharge to the southward. Here I saw the maple (*Negundo aceroides*) for the first time since leaving Rat Creek. Many large willows and thorn bushes (*Cratægus coccineus*) were observed on the neck of land that joins the two lakes, and over these hung in festoons the trailing vines of the Wild Hop, which in fact is found more or less along every water course. The shrubs of the dry ground were Elœagnus and Symphoricarpus and Roses. These are the shrubs of the plains and are found from Oak Point to the mountains. Between the Shallow lakes and Bird Tail Creek the land is good, and has been until very lately almost wholly covered with timber. Now the greater part of it remains as dead trees killed by last year's fires. The next one will probably take the rest. After leaving the creek a marked change takes place in the character of the country—the surface becomes covered with boulders; so thick do they lie in many places that it is difficult to pass amongst them. As we near the Assiniboine, the surface of the country becomes much broken up by various depressions and ridges, which seem to run in all directions without any apparent order.

Both banks of the Assiniboine and Qu'appelle rivers are densely wooded, but the wood is of no value, except for firing, as it is principally aspen and balsam poplar. A few maples and birch were observed at the crossing, but were of small size. The trail crosses the river about a mile above its confluence with the Qu'appelle. At certain times of the year the ford is impassable, owing to the shifting sands, of which the bed of the river is composed, and the depth of water. When we crossed, the channel was not more than fifty yards wide and the water a little over three feet deep. The river flows through a valley about 250 feet below the level of the prairie, and is very difficult to get out of with loaded carts on either side. After crossing the river, the trail wound up the bank, or rather steep face of the hill, which is almost wholly composed of sand and gravel. For ten miles the surface of the prairie was comparatively level, but sand and gravel predominates. Some years since it had been almost covered with a thick growth of Trailing Juniper (*Juniperus Sabina var. procumbens*) but now only the roots and dead stems were to be seen. About twenty miles from the river we crossed a plain in which there were a number of hills and ridges, climbed one and found it all gravel. After leaving this plain the country improved, and for over 80 miles, until we struck the Touch Wood Hills, we were passing through a rolling prairie country where wood and fresh water were both scarce; but the grass was astonishingly green—so much so that the whole party remarked the contrast between it and the brown pasture of Ontario, as seen in July, and this was the 10th of August.

The Touchwood Hills are much broken and have the appearance of having been at one time the shore of a lake or sea, as the outer hills seem more like ranges of sand dunes along a sea beach than anything else. The surface consists of shallow, brackish, lakelets, dry ponds, and rarely a marshy fresh water pool, interspersed among gravelly ridges, gently swelling hills and dry flats. The land surface is covered with a most luxuriant crop of grass and flowers, studded at short intervals with picturesque clumps of aspen and willow thickets. Much of the timber has lately been destroyed by fire, and a few years more will take the remainder. After getting well into the hills the soil improves and the luxuriance of the vegetation shows a very fertile soil. The "Great Prairie" lies immediately west of the Hills. This is a basin over 20 miles across; for more than two thirds of this distance the soil is saline, as evidenced by its flora, and for ten miles beyond, there is scarcely any wood, making nearly thirty miles without wood or good water. For the next thirty miles the country is very monotonous, being a rolling prairie dotted over with dry hills, poplar copse and willow-fringed thickets. For the last 60 miles the country is drier than any we have yet passed through and is doubtless very high, as it is almost on a level with the Touchwood Hills. On the night of the 14th of August we had frost on this plateau, but there was none at either Carleton or Edmonton at that time.

We now entered a labyrinth of hills and proceeded through them for about four miles when we came to a round hill, from the top of which we had a very extended view of the whole country. To the east and north an almost unbroken forest of aspen met the view, extending to the distant horizon, while to the south and west scarcely a tree was to be seen. From this hill to the south Saskatchewan, a distance of about 50 miles, the country is much broken, the whole surface being a continued series of lakelets, ponds and marshes—some fresh but the majority salt:—ridges, hills, narrow valleys and wide plains. Aspen copse and willow thickets were found always in depressions except on the Lumpy Hills, which had a very luxuriant vegetation. The immediate banks of the river on both sides were clothed with wood, but of few species; Aspen, Balsam poplar, White birch, Alders, Willows and a few other shrubs constituted the woody plants on both banks. Mosses were observed in the river valley, the first since leaving Rat Creek. The river flows through a narrow valley about half a mile wide, both the ascent and descent are pretty steep for the most of the distance. Its width is about 300 yards, average depth about 10 feet, with a stiff current, but much obstructed by sandbars in many places. From the level of the surrounding country to the bed of the river, 350 feet.

The distance from the South Branch to Carleton on the North Branch is about eighteen miles. For the first few miles after leaving the river the soil is sandy and of poor quality; but for the remaining distance it is excellent. Many lakes are scattered at intervals over the plain, and these, together with aspen and willows, give the country a very picturesque look.

The whole distance between Rat Creek and Fort Carleton, a tract of over 350 miles, is remarkable for the sameness of its flora. Very little change was noted after crossing the Assiniboine, except a few plants peculiar to sandy soils. The hill-top, the plain, the marsh, the aspen copse, the willow thicket,—each had its own flora throughout the whole region, never varying and scarcely ever becoming intermixed. Even the fresh water ponds could be noted by their grasses being different from those bordering the saline ones. Months afterwards, when crossing the woods and prairies bordering Peace River, I was not a little surprised to find the same species in precisely the same situations, though hundreds of miles further to the north-west. That there is a great uniformity respecting soil, humidity and temperature throughout this whole region is apparent from the unvarying character of its natural productions. How much of it is suited for the purposes of agriculture, a hurried ride through it cannot show. But this much was seen, that wherever the soil or the natural contour of the land would interfere with the raising of grain, immense herds of cattle, droves of horses and flocks of sheep could be raised. In proof of this I need only state that when I left Central Canada the pastures were nearly all dried up. Crossing this region during the month of August, all the party were struck with the greenness of the sward, although most of the grasses had ripened their seeds long before. This, taken in connection with the immense herds of buffalo that formerly grazed on those boundless plains, should cause the most sceptical to form a higher estimate of the value of this far off land. It requires very little prophetical skill to enable any one to foretell that very few years will elapse before this region will be teeming with flocks and herds.

In "Crofutt's Trans-Continental Tourist's Guide" occurs this passage, in speaking of the prairie west of Antelope, on the line of the Union Pacific Railway: "We now enter on the best grass country in the world;" and further on he says,: "The country is destined at no distant day to become the great pasture land of the continent." Now, I passed over these plains from Laramie to Antelope, which are represented as being the best grazing lands in the world, and which are now supporting thousands of cattle, and they bear no more comparison to our plains than a stubble field does to a meadow. While they have 1,000 miles of sage plains—for bunch grass soon dies out when pastured, and sage brush take its place—we have over 1,000 miles, from east to west, of land covered at all times of the year with a thick sward of the richest grass, and which is so nutritious as to keep horses in good condition though travelling, as ours did, at the rate of forty miles per day.

After crossing the North Saskatchewan, the trail led for a few miles through a partially wooded country. In many places, the grass and leguminous plants grew very luxuriantly, while in others the grass was short and crisp, or the land was low and covered with carices, grasses peculiar to wet soils and rushes (*Juncus Balticus*). The Thickwood Hills, which we now passed, are pretty rough, but have rich soil and abundance of the finest pasture. For many miles we passed through what had once been a forest, but now it had only a few rotten logs to tell the tale. We are certainly in a moister country than any we have yet passed, since leaving Oak Point, as mosses are beginning to appear, and the herbaceous plants indicate a cool moist climate.

In all the lakes we have passed, there are very few aquatic plants, Ranunculus, Polygonum, Potamogetons, Myriophyllum, and Hippuris, are the only ones. They are generally bordered with certain species of plants. If salt, a Compositæ, Glyceria, Wild Barley, a Senecio, and various species of Chenopodiaceæ. All fresh water pools are indicated by a grass peculiar to the plains, so that a person riding along can tell the water by its surroundings.

Leguminosæ and Compositæ are abundant everywhere. Rosaceæ are well represented by many species of Potentilla, while grasses, sedges and rushes make up the most of the herbage. Stipa, Triticum, and Calamagrostis are the leading types of the grass family.

Between the Thickwood Hills and Jack Fish Lake the country is partly plain and partly rough and hilly, but the greater part is well fitted for cultivation. The hills and ridges are either gravel or sand, but always covered with verdure. For thirty-three miles after passing Jack Fish Lake, the country is beautiful and the soil excellent, being a light brown sandy loam. Crossed Turtle River and entered a rougher region, soil nearly all gravel and covered at times with boulders. From English River to Fort Pitt the surface of the country is much broken, and ranges of hills with corresponding valleys are common. A marked change is taking place in the vegetation. The plants are of a more northern type, and indicate a cool moist climate. Many plants that were seen for the first time after crossing the Saskatchewan continued all the way to Peace River—through the Rocky Mountains—and finally disappeared at the Cascades. These were the remains of the forest flora, as the forest at no remote date certainly came to the river.

At Fort Pitt we had the pleasure of seeing a fine band of beautiful horses, numbering over 300, which showed by their sleek sides and finely rounded flanks that the Saskatchewan pastures were equal to any in keeping horses in good condition. Between Fort Pitt and Victoria the land changes every few miles, and is much broken by hill and valley. Many tracts have excellent soil, and would bring immense crops of all kinds, if not injured by summer frosts, which seem to be prevalent in this region. Willows and dwarf birch (*Betula pumila*) are at times very common, their growth being encouraged by the cold wet land. Before reaching Fort Pitt, a few pines or spruce were observed in the river valley, but as we proceeded towards Victoria many groves of Banksian Pine were seen, and occasional balsam, spruce, and tamarack. Whether this region will ever be a wheat-raising section is a question only to be answered by actual experience, but that there is no better country for raising stock can be told by any one. Peas, vetches, grasses, everything, grows most luxuriantly; there is an abundance of water and good shelter for cattle and horses both winter and summer.

At the Victoria Mission, wheat, barley, peas, oats and potatoes are successfully raised, together with all kinds of garden stuff. When we were there, (August 25th,) the barley was already cut, and some of the wheat was coloring, but the latest of it would not be worth anything, as it had heen injured by a frost on the 13th. The greater part of the crops are raised on the alluvial flats, near the river, but much land is cultivated a few miles to the north. The land around Victoria is very rich, and would produce enormous crops. Almost any of the land free from bushes and trees could be mowed, the grass is such a length.

Between Victoria and Edmonton, a distance of 80 miles, the soil is very rich, but there is much wet swampy land, the greater part however seems to be exceedingly fertile and well suited for agriculture. All around Edmonton, the land is of the very best quality, though the soil in some localities is scarcely as heavy as could be wished. The land on which the H. B. Co. raise their farm produce is a brown sandy loam, probably an alluvium. All kinds of grain, roots and vegetables are raised in abundance here. Fall wheat has never been tried, but I am certain would succeed as the snow covers the ground all winter and there are no spring frosts.

Most of their ploughing is done in April, and their grain is sown the first week in May. Last year, their barley was cut on the 12th of August, this year, they commenced the 27th, owing to the wet cold season. Wheat is a sure crop if put in early, as it is never affected by rust or mildew. It is very large in the berry and very plump. Potatoes are cultivated to a large extent, 4,000 bushels being raised by the H. B. Co. in 1871.

The country around Edmonton is much superior to that in the vicinity of Fort Garry, as there are no marsh or salt lands, and plenty of timber and excellent water.

SECTION II.—FROM THE NORTH SASKATCHEWAN, VIA PEACE RIVER, TO BRITISH COLUMBIA.

(1)—TOPOGRAPHY OF THE COUNTRY.

Fort Edmonton is situated on the left bank of the North Saskatchewan, 890 miles north west of Fort Garry, in North Latitude 53.32, and West Long. 113.17, and at an elevation of 2,088 feet above the sea level. The river here is about 200 yards wide, and flows through a narrow valley, about 300 feet deep. The waters of the Saskatchewan flow into lake Winnipeg, and from thence by Nelson's river into Hudson Bay. About 40 miles, by cartroad, from Edmonton is the height of land between the Saskatchewan and Athabasca rivers, the latter flowing by way of Slave lake and McKenzie river into the Arctic Ocean. It will be seen by reference to a map that all the rivers of the country flow in a north-easterly direction, and that a person travelling north west, will successively cross these streams and their watersheds. The watersheds are not different from those of any part of Canada, and consist of a series of lakes, ponds, marshes, muskegs, (peat bogs) and spruce swamps, interspersed with ridges covered with Banksian pine. The discharge of Lac La Nonne—a small stream about 10 yards wide and 15 inches deep—was the first water crossed that emptied into the Arctic ocean.

Between Edmonton and Lac La Nonne—a distance of about 49 miles by cartroad—the land is rolling, and at times rises into hills, which stretch away to the west, shutting in the view on that side. None of it is difficult, but the last half is much broken by hill and dale, swamp and lake. Between Lac La Nonne and the Pembina river the country is more broken, the hills are steeper and more heavily wooded, and the soil much poorer. The bed of the river where the trail crosses is a moving sand; it is about 100 yards wide, and in the deepest part the water touched the horse's packs—we had given up the carts at this time. This river rises in the foot hills of the Rocky mountains, and empties into tne Athabasca. Between the Pembina and Paddle rivers—a stream 20 yards wide, 10 inches deep—the land is comparatively level; after crossing it there is nothing can be called a hill until you reach the ridges which border the Athabasca. The level of the country is about 300 feet above the river, which flows through a pretty wide valley. The Athabasca is large, being wider and deeper than the Saskatchewan. The bank on the south side is only about 10 feet high, and of alluvium, while that on which Fort Assiniboine is built, is composed of 26 feet of gravel and only one of earth. The fort is built on a terrace, and there are indications that the river formerly flowed at a much higher level. To the north and west, the hills rise to what I suppose is the general level of the country. For some distance, after passing the Athabasca, the country is just a series of sand hills, ridges, and swamps. Afterwards it is less broken, but much wetter, being nearly one half swamp, or muskeg. For six days we were forcing our way through a dreary country, the surface of which was covered with a constant succession of swamps, muskegs, brulies, thickets of willows, and other shrubs and trees, until we reached the top of the Deer Mountains, which seem to be a spur of the Rocky Mountains. These mountains form the watershed between the streams flowing into the Athabasca and Little Slave rivers, and those flowing into Little Slave lake. As we receded from the Athabasca the country became more arctic in its appearance, and as we neared the top of the mountain, its vegetation shewed a high altitude. By aneroid the top was about 3,500 feet above the sea. The following extract from my journal will give a true picture of the whole region, as seen from the top of the mountains.

"Looking back from the summit, the dreary country we have been passing through for the last five days lay at our feet. In the blue distance we could see the hills bounding the Athabasca, while nearer were the swamps and muskegs, which caused us so much trouble. After going a few rods to the north, we saw, away to the northwest, and about 40 miles distant, the goal for which we are bound—Little Slave lake. Far down in the valley we could trace Swan river—by its timber—but could not see its waters. Away to the left, about 15 miles off, we could see House Mountain, even higher than the one we stood on. The whole valley at our feet seemed to be covered with a forest of pines and spruces, interspersed at intervals with aspen. A high wind prevailed at the time, and showers of hail and rain passing over the valley gave it a dreary, wintry look. We are so high up that the rain passes down the valley, and only the scud strikes the little pines, amongst which our tent is pitched. The pines (*Pinus inops*); on the verge of the mountain are old and stunted, not being more than twelve feet high.

"On the southern side of the mountain there is a gradual slope, but on the north it falls off almost perpendicularly. I made an excursion in search of mosses, and with much difficulty got down about 150 feet. I found that although for 40 or 50 feet the summit was covered with gravel, under that there were cliffs composed of soft sandstone, and still underneath them a layer of black shale (almost coal), and then a conglomerate like that at Edmonton."

The descent to the north west is very rapid, being over 1,000 feet in less than ten miles, to the valley of Swan River. Beyond this to the lake the ground falls rapidly, but mountains are seen constantly to the southwest.

The lake lies nearly east and west, and is about 75 miles long, with an average breadth of over 6 miles. The south shore is low and flat, and extensive marshy meadows extend around the south western end of it. How far the low grounds extend back from the lake it is hard to say, as the view is obstructed by willow thickets. The north shore is bolder, and presents a fine appearance as seen from the south side. A number of rivers flow into the lake on the south west side, but all are fordable except when the water is high.

The portage between Little Slave Lake and Smoky River is about 70 miles, and for the whole distance is through a level country, gently rolling in parts, but without a hill. For the last 30 miles it is a most lovely country, being part prairie and part aspen forest. The watershed betw een the lake and Peace River is known by the usual muskeg and swamp, but there is very little difference of level.

The approach to Peace River is not marked by any change in the level of the country. Without being aware of it the traveller finds himself standing on the margin of a deep valley, with a mighty river flowing through it at a depth of 600 feet below where he stands. Looking up the river he can see its course for many miles, as its winds through its valley and among the islands which are so marked a feature of its channel. A few miles up and farther to the left is Smoky River, a large stream flowing in a deep valley and mingling its waters with those of Peace River, a few miles above where the observer stands.

Right across the river, and beyond its valley, the land keeps the same level until in the dim distance land and sky seem to meet. This prairie extends all the way to Dunvegan, on the left bank, and how much further it is hard to say, as Indians have a very indefinite idea of distance. That the country is level for a great distance to the north is certain, as all parties were agreed on that point. But how far was another matter. The level country on the portage is said to extend either as prairie or aspen forest, right across Smoky River, and without a single hill to break its uniformity, until it reaches the Rocky Mountains. The Beaver ndians, who hunt on these plains, say they are at least 60 miles wide opposite Dunvegan, and from my own observation I have no doubt but that they extend in length from the Portage between Slave Lake and Peace River to the foot of the Rocky Mountains, a distance from east to west of 180 miles. Evidently the land rises all the way to the mountains, but the rise is scarcely perceptible.

Peace River is remarkable in many respects, whether we consider its size, the country on its banks, its passage through the mountains, or where it ultimately empties its waters.

The left bank all the way to the mountains, a distance of over 250 miles, is altogether devoid of timber, except in the hollows or valleys of the small streams which empty into the river; while on the right bank the forest is continuous all the way to and through the mountains. Spruce is the principal tree, but birch and aspen are sometimes seen. This is a marked feature of all the streams throughout the country. In all cases, the bank *facing* the south is either covered with grass or aspen, while the one *facing* the north is covered with a spruce forest having a thick carpet of moss. The cause is apparent; a light rainfall and exposure to the sun on the one hand, dries the ground, while the low altitude of the sun in this northern region, prevents evaporation on the other.

Another feature of the river is its valley, which is from 400 to 1,000 yards wide; through this valley it meanders, forming points, islands, sand or gravel bars, here running under a cliff at this side, now on that, but ever the same, when cutting into the bank at one side, throwing up a bar on the other. These points and islands are heavily wooded, mostly with poplar, but spruce, aspen and birch are not uncommon. They are from ten to fifteen feet above the water, and covered with excellent soil, but are subject to inundation. Any one sailing up the river would be impressed with the idea that he was sailing through a mountainous country, as the banks are constantly from 600 to 800 feet above him, in many places rising almost perpendicularly to the height of 300 feet and more. Exposures of sandstone, ferruginous and other gravel and clay are of constant occurrence, but whether the river is cutting through clay or sandstone, its current is ever the same, except where a mass of gravel obstructs its current; *then* it will be strong for a short distance, but rock never caused the slightest rapid all the way from Smoky River to the Canyon at the entrance to the mountain. About 25 miles below Dunvegan, the river channel is much confined by sandstone cliffs, but the current is not stronger than common, as the following quotation from my journal will show:

"From 2:40 p.m. until 5:30 p.m., were passing through the most enchanting and sublime scenery. Right bank of the river clothed with wood, except where too steep, or where there had been land slides. In many places it rose up from the shore to the height of from 300 to 600 feet. Sandstone often showed cliffs of 300 feet, especially below Green Island. The left bank was just as high, but, instead of wood, grassy slopes met the river, but land slides always revealed sandstone. In places, the river had cut a passage through the sandstone to the depth of 300 feet, and yet the current showed little increase. It was full from bank to bank, and fully 600 yards wide, and looked like a mighty canal cut by giants through a mountain. Up this we sped at the rate of four miles an hour, against the current, in a large boat belonging to the H. B. Co., propelled by a north east gale."

Terraces are of frequent occurrence, but not continuous, until we approach within 30 miles of the mountains, where they assume truly gigantic proportions; they are at various heights, but seem to rise higher as we approach the mountains, until at Hudson's Hope, at the lower end of the Canon, they attain their greatest height. Such immense masses of gravel seem to point to a time when the sea washed the base of the mountains, for no river could ever have made so much gravel out of foreign material. The bed rock here is sandstone and shale, while the pebbles are limestone containing fossils very like Devonian ones. About ten miles below the Canon, the river has cut itself a passage through a sandstone barrier, leaving a rocky island in the middle of the river, with a channel on each ering mountains, all are there. But anything approaching to a Canyon rge is not to be seen.

The Portage path, between Hudson's Hope and the mouth of the yon, passes over a series of sand hills and gravel ridges, which seem to n the flank of the mountain on the right. These, as we approached the took the form of terraces, and a number had to be descended before iver was reached. The path passes between the Portage mountain he left as you go up, and the Bull's Head on the right. The Canyon side of the Portage mountain and is a channel formed by the river its natural bed was filled with those immense heaps of sand and gravel up between the Portage and Bull's Head mountains. For many miles he river its valley is straight, but the river itself is very crooked. Very imes on looking down the river those two mountains came in view, ng plainly that they stood on either side of the natural valley. After two days on the river I wrote the following: "This river channel tural break in the mountains. Some great convulsion of nature seems e torn the mountains a mile apart and so left them. The only *ral* channel is the Canyon. All the mountains passed yet are merely ngs, as if a great pressure had come from the west and forced the up almost perpendicularly. The dip is always to the west." All y through the mountains there are only two rapids—one just before nter the main chain, the other after you leave it. In neither case the mountains any thing to do with the rapid. They are caused by of rock crossing the river, but are not very bad, as three men on e were able to haul our boat through.

eace river (or the Parsnip) above the Findlay Branch, runs through valley and has a very tortuous course, though its general direction ght, owing to the immense heaps of gravel that seem to fill every its bed. Every year its channel changes and new land is being just as rapidly as the old is wasted. Mountains extend ng the right bank, but are of no great height, and at some from the river. The country between the two rivers is low for istance; but the Ominica mountains rise in the distance and show e level country does not extend far back. Rocky hills or low ns are sometimes seen on the left bank, but are not continuous. s of any magnitude come in from the right bank ; but the Nation river that discharges the water of McLeod's Lake bring in consi- water from the left one. This shows that the watershed is to ward, and is another proof to me at least that the mountains are of itude for some distance south east of Peace River. (Parsnip)

whole country west of the Rocky mountains and east of the Cas- ems to have certain general characteristics that are found throughout ntry. The whole upper country seems to be a vast plateau with f rocky hills or low mountains running without order through its xtent. The rocky hills are generally covered with stunted Douglass *bies Douglassii*)—the wide gravelly plateaus with most diminutive Pine (*Pinus Banksiana*), while the swamps were covered with growth of Spruce (*Abies alba*). In the valleys of the river and a er favored localities, the Aspen poplar was still seen, but in decreasing numbers. Rivers and lakes full of speckled trout are found in every direction. The whole of that part of British Columbia lying between McLeod's Lake and Quesnelle on the Fraser, a distance of 270 miles by the way of Fort St. James on Stewart's Lake, consists of a series of lakes, rivers, rocky hills, and sandy or gravelly plateaus, covered with a scanty forest growth and of little account as an agricultural country. But the lakes and rivers teem with fish of the best quality. During the three days we remained at McLeod's Lake, Mr. Sinclair, the gentleman in charge of the fort, caught, in a basket very ingeniously placed at the discharge of the lake, 426 fish. These are dried for food and eaten by men and dogs, and likewise used for marten baits. They consisted of four species of trout, suckers, a fish called ling, and a small white fish which I take to be the same as the herring of the Bay of Quinte. A few of the trout were large, weighing from 6 to 8 lbs.

Stewart's river, which discharges Stewart's Lake, is, where I crossed it 211 yards wide; while the Nechaco, another branch of the same river, is over 300 yards wide, with a rapid current. These constitute the west branch of the Fraser. The Nechaco is fully as wide as the Fraser at Quesnelle. The only other river of any size is the Black Water or "West Road River" which was about 60 yards wide where I crossed it. The valley on the north side of the Nechaco is of considerable width and is composed of excellent soil. This is the largest tract of good land seen west of the mountains. The land at Fort George seems to be level, but having been seen at a great distance I cannot speak positively of it. As the Fraser has been repeatedly described, it is needless for me to make any remarks regarding it.

(2.) GEOLOGY AND MINERALS.

A few observations on the Geology of the country explored may not be amiss, but they are necessarily crude, owing to the want of time and the hurried nature of the expedition.

The superficial geology of the country is the same all the way from Edmonton to the Rocky Mountain Canon. The beds of all the streams crossed had the same gravel as that seen at Edmonton. Whenever gravel was exposed on our route at other points it was the same, and even in the Rocky Mountains and through them up the Peace River the gravel had much the same character. The bars that produce the fine flour gold of the Peace River are identical in composition with those that are worked at Edmonton. We were told that every little stream in the upper part of British Columbia produced gold, though not always in paying quantities. There is no doubt but that immense quantities of gold will yet be brought from the Ominica country, as from the accounts of both successful and unsuccessful miners it was clear that the country had not been prospected yet to any extent, and owing to the great quantities of gravel that filled up the valleys it was next to impossible to tell where the old bed of the stream was.

I came down to Victoria with a miner named Guest, who was one of a party of eight that took 286 ounces of dust out of a claim on Lost Creek —a branch of the Ominica—the last week they worked in the fall. He had over 100 oz. of this dust with him. It was all in scales or flattened oval nuggets, and not at all like the Cariboo gold. It assayed over $17.80 per oz. in San Francisco.

Coal like that at Edmonton was found in blocks in the bed of the Pembina River, and in ledges on the northern face of the Deer Mountains; also in the bed and along the bank of Swan River, a tributary of Little Slave Lake. Many blocks seen at this point were quite large, and showed the wood fibre, leading me to the conclusion that it was lignite. Specimens of this were left at McLeod's Lake. We tried this coal in the camp fire and it burnt with some flame, but left much ash of a yellow or white color. All the specimens did not leave the same ash. The following is a section of the river bank at this point:

1 foot of soil.
3 feet of water washed gravel.
8 " light grey clay.
2 " black shaly clay.
1 " lignite.
4 " bluish clay.
6 " black shale and blue clay intermixed to the river's bed

Tons of coal were lying in the bed of the stream, which evidently came from above. Mr. King found coal on the shore of Little Slave Lake, which seemed like that found in Swan river. Ten miles from Swan river, on the north western face of Deer mountains, landslides had taken place and exposed the whole face of the mountain for 150 feet from the top. About forty or fifty feet of the top was the usual gravel, and beneath this sandstone cliffs of excellent grit fit for grindstones, then a layer of black shale (a poor quality of coal) and beneath this beds of dark colored clay filled with nodules of clay ironstone.

Slave Lake seems to lie in a depression between two series of rocks, as there is no analogy between the land of the south shore and that of the north. In former times it must have stood at a much higher level than it does now, as we passed over gravel bars running parallel with the shore, two or three miles inland, that seemed from their appearance as if the water had covered them but yesterday, they looked so clean and free from foreign matters. Along the northern end of the lake the pebbles and boulders are nearly all sandstone, differing from all the others we have seen. The sandstone is very similar to that seen on the Deer Mountains, but is of finer grit. Any of the pebbles make good whetstones. Many of the blocks were still angular, showing that sandstone must be in *situ* somewhere near. Grey limestone (sometimes a conglomerate) and gneiss boulders complete the rocks.

We saw no more rock for 70 miles until we struck Peace River, at the mouth of Heart River, a few miles below the mouth of Smoky River. Here we found sandstone cliffs about a mile up the stream. These crossed the river and ran diagonally, as an escarpment, to Peace River, crossing which they were fully 100 feet high on the left bank, and seemed to run down stream for some distance.

Between Smoky River and Dunvegan, a distance by river of probably miles, there are many exposures of rock but of an unvarying character til within a few miles of the latter place. In a number of places sandne cliffs would tower up from 200 to 300 feet, while in others they would e only a few feet; in others again clay shale, passing into slate or sandy y, passing into sandstone, was seen. A few miles below Dunvegan we sed, on the left bank, a series of sandstone cliffs which rose to the ght of about 100 feet. They were very much weather worn and nged into many fantastic forms by the wasting of the softer parts of the k and the leaving of the harder ones. The upper part of the rock being der was less wasted. and hence capped the other parts, causing them ook like a wall with a heavy cornice. Lying right on the top of this s a thick coating of large rounded boulders.

About two miles below Dunvegan I noticed many maritime plants wing at the base of the cliff, and this was the case for the same distance ve. After an examination I found that these grew around and in alkae springs. One of these I traced up the cliff, and at about 250 feet above river found the source of it. The seat of the alkali was in the sandne at this height above the river, for at least three miles above and below fort. The surface of the rock in a number of places was covered with white incrustation, and the springs incrusted the grass and twigs with autiful little crystals. Above St John's the river bank for many miles full of this same substance, which probably has its source in the sandone, though the rock is not exposed. This is probably the "sulphate of ne" spoken of by Colonel Lefroy as occurring at Dunvegan. This is **No.** of the specimens sent.

We left the river at Dunvegan, and went overland to St. Johns. By oing so we had an opportunity of seeing the country inland, and many ne sections of river banks. About sixteen miles from Dunvegan we ame to a small stream flowing in a narrow valley about 280 feet in depth, here I made a number of discoveries. The coal or bituminous shale umbered , and the fossils were found here. The following xtract from my journal will explain: "While dinner was being prepared took my usual exploratory trip. In the bed of the creek found the same ark-colored ferruginous shale I had observed on Peace River. In the reek were many angular blocks of an imperfect limestone, changing to a onglomerate, which could be seen in layers in situations about 150 feet bove the bed of the stream. At this point the creek forked, and on the outh branch I found a clay bank with the usual prairie soil for a number f feet, then a clay containing a substance like soda, but tasting like alum. Underneath was the shale, and then a thin layer of coal, or bituminous hale, then conglomerate limestone, and beneath this a thin layer containng animal remains, out of which I picked a few teeth and some specimens ontaining other parts of an animal. Many pebbles encrusted with iron ust were around; pebbles like these had been frequently seen on Peace River."

After travelling for three days through a beautiful country, we came on nother deep "coolie," or ravine, in which flowed a small stream. From he level of the plain to the water was 280 feet by aneroid. Close to where we dined a slide had taken place, leaving a full section of the bank exposed. About five feet of the surface was the regular prairie loam, next about thirty feet of dark-colored stratified clay then probably 100 feet of yellowish clay, then a band of yellowish limestone outside, but light grey within, and afterwards for many feet clay and limestone bands intermixed. The remaining distance is black shale, which sometimes has a conchoidal and at others a slaty cleavage A few miles beyond this we came to a river which had high mural cliffs of yellowish clay, rising almost perpendicularly from the water, to the height of at least 220 feet. In the bed of the river I observed a conglomerate sandstone dipping slightly to the westward, and on the left bank about four feet of the same kind of rock in horizontal layers. Part of it seemed to contain calcareous matter. Another exposure showed sandstone, then clay and clay changing into shale, and at the base sandstone conglomerate. Limestone boulders were seen in the bed of the river, but no fossils observed.

Another large river was crossed, but there were no rock exposures. Mural clay cliffs rose in many places to 150 feet. They are of the usual character, yellowish clay, getting darker towards the base The pebbles were nearly all thin flakes of sandstone, intermixed with ferruginous ones, others of blue limestone and red granite. These seem to have come from near the source of this river. Crossed a few small streams after this and saw sandstone slabs in their beds.

The Epinette or Pine River is quite large. Just at the crossing, about a mile above its confluence with Peace River, a small stream enters it from the south. This stream has cut down the cliff to the water's edge, leaving a very good section of it exposed. The upper part is the usual yellowish clay, underneath is about twenty feet of gravel, and the remainder black shaly clay, sometimes hardening into rock. This black shale contains nodules shaped like a flattened hemisphere, and when broken show a crystalline centre surrounded by ferruginous matter. Other stones are flat, and have layers of a mineral which looks like selenite (No.)

At St. John's the Peace River flows in a valley over 800 feet deep. The banks do not show any rock, but clay cliffs are common. I ascended the river all the way from here to Hudson's Hope, and noticed that the character of the river was very different from that below Dunvegan. Wide and extensive terraces became very common, and were at all heights, but the principal ones ranged from 150 feet and upwards in height. One we crossed between the Epinette and St. John's was fully 180 feet high and three miles wide, and as level as a race course. Above the Half-way River, about 20 miles below Hudson's Hope, terraces are numerous and continuous, showing on either side of the river as it winds through its valley, and unmistakably proving that they were there before the present river bed was cut out. At the foot of the Canon, they rise in regular steps many hundred feet above the river, and cause much difficulty to parties crossing the Portage, owing to the steepness of their sides.

Immediately above St. John's on the right bank there is a high bluff which consists of, first, fine rich soil, then a few feet of gravel, and the remainder to the water's edge a limestone conglomerate intermixed with clay beds and shale. Clay cliffs with limestone conglomerate and clay impregnated with soda were of constant occurrence for many miles. Sandstone certainly overlies this conglomerate, as it is found in angular masses in all the little brooks that enter the river. Farther up ferruginous shale was quite common, with layers of harder rock between. Crystals of selenite were picked up at this time. A little after the river took a sudden bend to the west, and as we moved westward, in our rear, on the left bank, rose a mountain fully 1,000 feet high. About 500 feet had slidden away from the top and left it exposed. The whole of the rock exposed was sandstone of excellent quality, as could be seen by the masses lying in the river. A few miles above this the river runs under conglomerate and shale cliffs, capped with gravel fully 100 feet thick. This gravel was constantly falling, and we ran some risk in passing underneath. Still farther up another series of cliffs, but this time they are capped with yellowish clay, beneath this about 40 feet of ferruginous limestone gravel, and to the water's edge the usual shale. This arrangement of the strata was the rule for a number of miles, and no other rock exposures were seen until we were a few miles above Halfway River. The rock now exposed is shale or slate, and for the first time the river has a rocky bottom. This continues for miles, but there is no increase of current. About 6 miles below Hudson's Hope we see the first and last rocky island seen in Peace River. At this point high cliffs of a very coarse sandstone show on both sides of the river, with the rocky island between rising as high as they do. Here the river was probably stopped for ages, and formed a waterfall of from 60 to 100 feet in height. The rock exposures after this were slate, except a rock formed by the drippings of springs out of those immense gravel terraces spoken of above. Opposite Hudson's Hope this rock was so largely developed that it assumed the appearance of regular cliffs, fully 50 feet in height. Farther down the river I had observed the same rock, but not in such quantities. It is probably calcareous tufa.

Spent a few hours botanizing around the head of the Canon, and made the following entry in my journal regarding the rocks: "The rock itself, close to the level of the water, is a hard, black, slaty-looking mass; overlying it are a few layers of a hard conglomerate, then a little reddish sandstone, overlaid by about two feet of slaty shale. Above this is a layer of hard conglomerate, containing greenish pebbles, and over all great masses of compact sandstone, very hard and of a light color. All the rocks are hard and quite different from those below the Canon. Great floods evidently take place here as is seen by the piles of driftwood. There are a great number of potholes worked in the rock, many of them being quite large and deep."

Almost due west from the Canyon is a mountain rising from 1,000 to 2,000 feet. Its base, we ascertained, came to the river over fifteen miles away. No rock exposures along the river for nearly twenty miles; then a very little of the same rock as formed the lower beds at the Canon. We were passing through the outer range of mountains all the time. Rocks on the mountains, weather whitish, and are massive in their stratification. Layers lying horizontally. Afterwards passed an exposure of slate, very much tilted, with the dip to the west. The upper part of the mountains is sandstone and lies in horizontal layers. Many of the mountains were very beautiful, their lower slopes being covered with grass, while the rock of the upper parts stood out in bold escarpments, looking like the battlements of ruined towers. Much sandstone was seen in the beds of the small streams, while the gravel of the main river was principally blue limestone containing many fossil shells. Specimens were left at McLeod's Fort.

The mountains seem to be great foldings forced up by a power moving from the west; the dip is always in that direction, and the peaks seem like the tops of regular anticlinals. I am satisfied that Peace River flows through a rent formed at the upheaval of the mountains. The only opening made by the river is the *Canon*. It ran in its present channel before the "Glacial Period," and then passed between the Bull's Head and Portage Mountains. At that time the channel was filled up with sand and shingle. When the land rose the water made a passage for itself round the Portage Mountain, and hence the Canon which has most certainly *been cut by the river*.

The last rapid in the river is about one mile below the confluence of the Findley Branch with the Parsnip. It is caused by a ledge of talcose schist interstratified with quartz, which crosses the river at this spot. This same rock, is seen at various points for about a mile up the Parsnip, when it disappears. Miners say that this is the bed rock of the Ominica country. Very few rock exposures were seen on the Parsnip, but what there were were limestone and conglomerate. No sandstone was seen west of the mountains.

A few blocks of black shale, resembling coal, were observed lying on the bars, but none in *situ*. As winter had set in at this time and the surface of the ground was covered with snow, I could make but few observations after this.

There is no doubt but that the whole district between Little Slave Lake and the Rocky Mountains, including the Smoky River country, and probably along the whole eastern base of the Rocky Mountains, up to the Arctic Ocean, belongs to the Divisions E and F of Dr. Hector's Report in Captain Palliser's Exploration of British North America. He shows that Group E is the same rock which produces the coal of Nanaimo, Vancouver Island, and my notes will prove that Peace River, east of the mountains, runs through just such strata.

(3) THE BOTANY OF THE REGION TRAVERSED.

In a hasty exploration like what ours was, it was almost impossible to do justice to any one subject. Still enough was seen to fill the mind of the most casual observer with wonder at the luxuriance of the herbaceous vegetation throughout the whole district traversed up to the Rocky Mountains, one portion only excepted—the Deer Mountains, south-east of Slave Lake.

From Edmonton to Lac La Nonne, a distance of thirty miles, the whole country, where not covered with wood, was either meadow or the finest pasture, abounding with the most nutritious grasses, and the woods and thickets filled with the vines of the Pea and Vetch (*Lathyrus ochroleucus* *and Vicia Americana*). The lakes were bordered by meadows having grass and sedges growing on them from three to five feet high, and as close as it could stand. Blue Joint (*Calamagrostis Canadensis*), Fowl Meadow (*Poa Serotina*), and Awned Sedge (*Carex aristata*), are the leading forms in these meadows and low grounds generally. While the dry grounds and hills supported a heavy growth of Triticum, Vilfa, Festuca, Bromus, Muhlenbergia and Andropogon, of the following species:

Triticum repens,
" caninum ?
Bromus ciliatus,
" Kalmii,
" —— ?

Vilfa cuspidata,
Festuca ovina,
Muhlenbergia glomerata,
Andropogon scoparius,
" furcatus.

Between Lac La Nonne and Fort Assiniboine, on the Athabasca, the most of the country is heavily wooded, the leading timber being Spruce and Balsam Poplar, though Aspen, Banksian Pine, Birch, Willow and Alder were abundant. Tamarac was observed in a few places. Much of the timber was quite large, many of the Poplars (*Populus Balsamifera*) and Spruces (*Abies alba*) being over two feet in diameter. The average size was from 15 to 20 inches. Wherever the timber was burnt off, wild peas and vetches covered the ground and ran over all the bushes. *Epilobium angustifolium*, a *Penstemon*, a *Delphinium*, and *Lophanthus anisatus* were very abundant, while many plants common in the forests of Ontario and Quebec were seen for the first time since leaving the Lake of the Woods. The leading shrubs were Cranberries (*Viburnum Opulus and pauciflorum*), Service Berries (*Amelanchir Canadensis var oblongifolia*), various Gooseberries and Currants, Hazel nuts (*Corylus rostratus*), Choke Cherries (*Prunus serotina*), Wild roses (*Rosa blanda*), and a few others.

From Fort Assiniboine to Little Slave Lake, a distance, by trail, of 150 miles, is also wooded more or less, but owing to its elevation and the nature of the soil, the timber is of small size. Black Spruce (*Abies niger*) and a Pine closely allied to Pinus Banksiana (*Pinus inops*) are very abundant over large areas east of the Deer Mountains. Near the top of the mountains, Balsam Fir (*Abies balsamifera*) was common, and was not seen again until we were west of the Rocky Mountains. On the extreme top of the mountain, at an altitude of perhaps 3,500 feet, many sub-arctic species were detected, which appeared again on the trail between McLeod's Lake and Fort St. James. On the top were found the following species:

Vaccinium Canadense,
" cœspitosum,
" Myrtillus,
" Vitis Idœa,
Empetrum nigrum,
Scapania irrigua,

Pyrus sambucifolia,
Senecio triangularis,
Epilobium alpinum,
Lecedea geographica,
Sterecaulon paschale,
Scapania sub-alpina.

Many Lake Superior plants were found, and others inhabiting the cool moist woods of Ontario. From Fort Assiniboine to the top of the mountains, Ericaceous shrubs were very common. Their berries often make a very acceptable dessert after our allowance of pemican. The slope of the mountains facing Slave Lake is neither so wet nor so cold as the opposite one. The very swamps change their mosses, and instead of Sphagni—Peat Moss—various species of Dicranum and Hypnum take their place. Many species found in the woods of Central Canada are now detected, and as we approach the lake, familiar forms are constantly seen. Ferns, which are altogether absent on the Plains, if we except a species of Botrychium, begin to show themselves, but are still so scarce as to be remarkable only for their *scarcity*.

Asplenium filix-fœmina,	Aspidium intermedium,
Crystopteris fragilis,	Phegopteris Dryopteris,

were the only ones observed in the whole region.

Along the shores of the lake were wide and extensive meadows, covered with a most astonishing growth of various grasses, but chief among them was the Blue Joint, which actually grew so tall and thick that loaded horses could scarcely force their way through it. A few notes taken from my journal as we passed up the shore of Slave Lake, will give an idea of the appearance of this section of country.

"After this we got into higher land, the soil improved, there was less wood and more open land, which was covered with a rank growth of blue-joint. The last mile was over level plain, wholly denuded of trees, and now covered with grass five feet high, various species of Golden Rod, Willow Herb, (*Epilobium angustifolium*) Cow Parsnip, (*Heracleum lanatum*) Roses, Snow Berry, (*Symphoricarpus occidentalis*) and a Honeysuckle (*Lonicera involucrata*). Before reaching the lake, we passed over a lighter soil, and through thickets rendered almost impassable by the trailing stems of the pea and vetch. After reaching the lake we pursued our way along its margin—now passing through blue-joint up to the shoulders—now Reed Canary Grass [*Phalaris arundinacea*] and sometimes Awned Carex [*Carex aristata*]. The lake shore is fringed with Bull-rush [*Scirpus riparial*], Cat-tail [*Typha latifolia*] and many other common species. The lake here is about five miles wide, and the opposite shore seems to rise into gentle hills, covered with Aspen [*Populus tremuloides*], interspersed at intervals with Spruce." Next day—the vegetation is even more luxuriant, the whole country is one vast meadow, covered with tall grass and willow bushes—so that I note in my journal that: "There must be a hot summer here, or the grasses never could attain such an enormous size. Much of the blue-joint was actually higher than my head, this morning. The soil here is alluvial, but how far it extends we have no means of determining, as our vision is bounded by willow bushes. Toiled for over six miles through extremely thick and tall grass, willow bushes, and rank vegetation generally, arriving at last at the goal of all our expectations—the crossing to Slave Post. This is a narrow part of the lake and about two miles from the Post."

Many tons of hay had been cut by the halfbreeds, for the use of the Post, but it was on marshy islands in the upper part of the lake.

Made a special collection of the plants around this part of the lake, which will be given in its proper place. Leaving out the western species, all the others are common to Central Canada. I detected 146 species, not one of which indicates an arctic or sub-arctic climate.

Between Little Slave Post and Smoky river, [the crossing of Peace River is five miles below the mouth of Smoky River] the vegetation is very similar to that around Edmonton, but wants a few prairie forms. By trail it is about 70 miles, and for the whole distance there is scarcely an acre of bad land.

From the Post a number of bare hills could be seen rising from the margin of the lake at its northern corner. These I took to be barren, but what was my astonishment to find that they were actually covered with prairie plants. I found afterwards that this was no uncommon occurrence, but that in *all* cases, up to the base of the mountains, hillsides or river banks, with a southwestern aspect, were devoid of trees, and clothed with a flora having a more southern tendency than the latitude would warrant. Two causes produced this—inclination to the sun, and a scarcity of moisture, caused by the constant evaporation during the long summer days. In opposition to this, all slopes and river banks having a northeastern slope were covered with a thick carpet of moss and coniferous trees. Peace River and *all* its tributaries are of this character.

For many miles the path leads through aspen woods with the usual forest flowers, but no decided change takes place until we reach the height of land between Peace river and Slave Lake. Here a number of species show themselves that had been seen in the muskegs east of Deer mountains. The only ones worth remarking are the Arctic Raspberry [*Rubus arcticus*], Cloud Berry [*Rubus Chamæmorus*], and Black Crowberry [*Empetum nigrum*]. Although it is a summit, there is no sign of a hill but merely level moorland covered with willows and Dwarf Birch [*Betula pumila*], with a muskeg or two to vary the monotony. Copse and grassy glades, interspersed with marshy spots, soon took the place of these, eventually to pass into a level plain that extends for many miles. In my journal I entered the following. "The last eight miles have exceeded anything in beauty and fertility I have seen since leaving Edmonton. Far as the eye could reach," [we were travelling at this time through a prairie] "and, on the left, the view extended for many miles, aspen copse interspersed with willows met the gaze. We were passing along a creek, and the land rose with a very gentle slope on either hand, giving us an opportunity of seeing for a great distance. This prairie had at one time been covered with trees, as the blackened trunks scattered over the ground plainly showed." No change took place after this until we reached Peace river, where I detected many species peculiar to river bottoms, but none worth a special notice. On the grassy slopes leading down to the river I found the Three Flowered Geum [*Geum triforum*]. The Pasque Flower [*Anemone patens*] and an Oxytropis (*Oxytrophis splendens*) in full flower. Evidently a long spell of dry weather had been followed by rains and warm weather to cause spring flowers to be in beautiful flower in October.

Mr. Horetzki rode over the portage, between Smoky River and Dunvegan, a distance of at least 40 miles, and told me it was beautiful prairie all the way. This was on the north or left bank of the river. As I proceeded up the river, I could see that the left bank was a constant succession of grassy slopes with aspen copse and Service Berry thickets in the hollows. The right bank on the other hand was always wooded, the timber being Aspen, White Birch and Spruce. The islands and points that formed the secondary bank of the river were generally covered with balsam Poplar of a large size, but spruce, aspen and birch were in considerable quantities. Long Leaved Willow [*Salix longifolia*] first took possession of the recently formed mud banks, quickly followed by Balsam Poplar, which, on the same island, could be seen passing from a seedling of a year old up to the hoary monarch over six feet in diameter. As the islands get old, Poplar gives place to Spruce, and this holds good for the whole extent of the river. Spruce was never observed on new islands, but always on the old ones. The same order of succession takes place on the Lower Fraser.

Silver Berry [*Elægnus argentea*] was just as common along Peace River as it was at Fort Garry, and served the same purpose, being the chief food of the prairie chicken, which abounds on all the prairies we passed over. I expected to find many new species on Peace River, but was disappointed. The Saskatchewan and Peace River are much alike in this respect, neither causing any appreciable change in the distribution of species.

At Dunvegan, made a special enumeration of the flora in the vicinity, but the season was getting so late that many fragile species had disappeared. One novelty was found on the grassy slopes in rear of the fort—Prickly Pear [*Opuntia*]. This was the first of the Cactus Family I had seen in the country, and was not prepared to find it in latitude 56° 8′ which is that of Dunvegan. This settled the question of the aridity of the exposed slopes of Peace River, and the Padre confirmed it by telling me that irrigation is actually necessary to the raising of good garden stuff on the terrace on which the fort is built. The fort is on the left bank and the land slopes to the sun.

We went overland to St John's, a distance of about 120 miles. This time the trail was on the right bank; part of the way through woods, the remainder prairie. Yet in this whole distance I only saw two plants not before seen, viz.: *Rhinanthus Crista-galli* and *Rubus Nutkanus*.

The woods were of the usual character, being composed of the same species, and found growing in the same situations. All the watersheds between the rivers were covered with heavy growths of Black Spruce, Banksian Pine, Aspen and Balsam Poplar, while the drier slopes were either prairie, or aspen copse, or forest. Much of the land now bare of trees had supported a forest of aspen a few years since, as their remains were still to be seen.

The following extract was written the day after I left Dunvegan:—
"For six miles after leaving camp the country remained the same as yesterday. It was gently rolling, yet not a height or depression was equal to ten feet. Drainage perfect. Every hollow was connected with others, and hence there was no marsh. The country was almost denuded of trees, probably by fires, and had much the appearance of prairie without its

uniformity. After this the country assumed a park-like character—was almost a dead level and more than half covered with trees. These eight or ten miles are ahead of anything for beauty and fertility we have yet seen." About seventy miles from Dunvegan we came on what is called the "Mosquito Prairie" by the Beaver Indians. Here the Indians resort in great numbers to collect Service Berries, which grow to a large size and are very sweet These berries are used in many ways, but the Indian women seem to prefer making them into square cakes and drying them. The leading vegetable forms on this prairie were the following :

Anemone patens,
" Virginiana,
Geum triflorum
Potentilla arguta,
" Pennsylvanica,
" ———?
Amelanchier Canadensis,
Achillœa millefolium,
Hedysarum borealis,
Rosa blanda,
Orthocarpus luteus,
Bromus Kalmii,
Triticum repens,
" ———?
Aira cœspitosa,
Poa serotina

Aster multiflorus,
" lœvis,
Solidago arguta,
" Canadensis,
Troximon glaucum,
Oxytropis splendens,
Elagnus argentea,
Vicia Americana,
Lathyrus ochroleucus,
Artemisia frigida,
" discolor,
Stipa Richardsonii,
" membranacea,
Trisetum subspicatum,
Calamagrostis Canadensis,
" stricta.

Every plant on this list grows around Edmonton, and all grow where wheat will come to perfection. Service Berries are never injured by frost on this prairie, and its vegetation shows no signs of being injured by it. The Indians say that the "Big Prairie," extending for more than two days journey for a saddle horse, south-west of this, is covered with just such plants and flowers.

Winter was coming on apace, and by the time we reached the Rocky Mountains most plants had become dried up, still enough were seen to show that the mountains were not the dividing line between the eastern and western flora. At the Canon a few new ones were seen, *Anemone pariflora* and *Saxifrage tricuspidata* being the most note-worthy.

Going up the Parsnip, I picked up a number of specimens, and between McLeod's Lake and Fort St. James enough to make 98 species ; of these no less than 64 species are found in the County of Hastings. From Stewart's Lake to Quesnelle, I collected 147 species, and of these 89 grow in the same county. On my way down the Fraser I noticed that eastern forms held sway until we came to Clinton, at the commencement of the Cascades. After that all was changed, and western forms took their place.

The flora of the whole region traversed east of the mountains indicates a climate with sufficient moisture to keep up a continuous growth, while at the same time there is heat enough to bring the seeds of all the plants enumerated to perfection.

Had I seen the Peace River country in summer, when its trees were in full leaf, and the meadows covered with waving grass and bright flowers, it might naturally have been supposed that I have used too strong language. But passing through it when the trees were nearly leafless, the grass and flowers withered and dead, I might be expected to not tell much in its favor. Yet there was no tract to equal it in my estimation between Fort Garry and Edmonton.

The appended lists will show the relation the flora of this region bears to that of Ontario and Quebec. Complete lists having been made at Fort Assiniboine on the Athabasca, at Little Slave Lake, and at Dunvegan on Peace River. The most marked feature in the whole region is the wide range of almost every species. Nearly all those that do not extend to Ontario are prairie plants, and are found around Fort Garry. Many species seem to have worked their way east of the mountains, and were not far out on the plains, while others from the east gave out before they reached the mountains.

List of Plants detected, between Little Slave Lake and Hudson's Hope, on Peace River, at the head of the Rocky Mountains. The greater number were detected between the fifty-fifth and fifty-sixth parallels.

	Belleville.	Quebec.	Western Plains.	Lake Superior.
RANUNCULACEÆ.				
1 Anemone patens var. Nuttalliana, Gray	......	......	1	
2 " multifida, D. C.	......	1	1	1
3 " Virginiana, L.	1	1	1	1
4 " Pennsylvanica, L.	1	1	1	1
5 Thalictrum Cornuti, L	1	1	1	1
6 " dioicum, L.	1	1	1	1
7 Ranunculus aquatilis, L	1	1	1	1
8 " multifidus, Pursh	1	1	1	
9 " Cymbalaria, Pursh	......	1	1	1
10 " sceleratus, L.	1	1	1	1
11 " Pennsylvanicus, L.	1	1	......	1
12 " repens, L.	1	1	1	1
13 Caltha palustris, L.	1	1	1	1
14 " natans	......	......	1	
15 Delphinium scopulorum, Gray	......	......	1	
16 Actæa rubra, L.	1	1	1	1
17 " alba, Bigel.	1	1	1	1
FUMARIACEÆ.				
17 Corydalis aurea, Pursh	1	1	1	1
19 " glauca, Willd	1	1	......	1
CRUCIFERÆ.				
20 Nasturtium palustre, D. C	1	1	1	1
21 Cardamine hirsuta, L.	1	1	1	
22 Arabis hirsuta, Scop.	1	1	1	1
23 " perfoliata, Gray	1	......	1	
24 " Drummondii, Gray	1	......	1	1
25 Erysimum chieranthoides, L	1	1	1	1
26 Sisymbrium canescens, Nutt.	......	......	1	1
27 Draba, nemorosa, L.	......	......	1	1
28 ———————	......	......	......	1
29 Capsella Bursa pastoris, March	1	1	1	1
30 Lepidium Virginicum, L.	1	1	1	
SARRACENIACEÆ.				
31 Sarracenia purpurea, L.	1	1	......	1

List of Plants, detected, &c.—*Continued.*

	Belle-ville.	Quebec.	Western Plains.	Lake Superior.
VIOLACEÆ.				
32 Viola blanda, Willd	1	1	1	1
33 " cucullata, Ait	1	1	......	1
34 " canina var., *Sylvestris*, Grs	1	1	1	1
35 " Canadensis, L	1	1	1	1
CARYOPHYLLACEÆ.				
36 Silene Drummondii, Hook	......	......	1	
37 Stellaria media, Smith	1	1	......	1
38 " longifolia, Muhl	1	1	1	1
39 " longipes, Goldie	1	1	1	
40 " borealis, Bigel	1	1	......	1
41 Cerastium arvense, L	1	1	1	1
GERANIACEÆ.				
42 Geranium Carolianum, L	1	1	1	1
LINACEÆ.				
43 Linum perenne, L	......	......	1	1
LEGUMINOSÆ.				
44 Astragalus Canadensis, L	1	1	1	1
45 Oxytropus campestris, L	......	1	1	
46 " Lamberti, Pursh	.....	......	1	
47 " splendens, Dougl	......	......	1	
48 " deflexa, DC	......	.....	1	
49 Hedysarum boreale, Nutt	......	1	1	
50 Vicia Americana, Muhl	......	......	1	1
51 Lathyrus ochroleucus, Hook	1	......	1	1
ROSACEÆ.				
52 Prunus Pennsylvanica, L	1	1	1	1
53 " serotina, Ehrh	1	1	1	1
54 Geum strictum, Pursh	1	1	1	1
55 " triflorum, Ait	1	......	1	1
56 " rivale, L	1	1	......	
57 Potentilla Norvegica, L	1	1	1	1
58 " Pennsylvanica, L	......		1	
59 " pulichearima, Lehm	......	......	1	
60 " arguta, Pursh	1	1	1	1
61 " Anserina, L	1	1	1	1
62 " tridentata, Ait	......	1	......	1
63 " palustris, Scop	1	1	......	1
64 " diversifolia, Lehm	......	......	1	
65 " effusa, Dougl	......	......	1	
66 Fragaria Virginiana, Ehrh	1	1	1	1
67 Rubus Nutkanus, Moc	......	......	......	1
68 " Chamæmorus, L	......	1	......	
69 " triflorus, Richardson	1	1	1	1
70 " arcticus, L. 2	......	......	1	
71 " strigosus, Michn	1	1	1	1
72 Rosa blanda, Ait	1	1	1	1
73 Amelanchier Canadensis, Torr	1	1	1	
SAXIFRAGACEÆ.				
74 Ribes oxycanthoides	......	1	1	1
75 " lacustre, Poir	1	1	......	1
76 " floridum, L	1	1	1	1
77 " rubrum, L	1	1	1	1
78 Parnassia palustris, L	......	1	1	1
79 Saxifraga Virginiensis, Michx	1	1	......	1
80 Heuchera Richardsonii, R. Br	......	......	1	1
81 Mitella nuda, L	1	1	1	1
CAASSULACEÆ.				
82 Sedum Rhodiola, D	......	1		
HALORAGEÆ.				
83 Hippurus vulgaris, L	1	1	1	1

List of Plants, detected, &c.—*Continued.*

	Belle-ville.	Quebec.	Western Plains.	Lake Superior
ONAGRACEÆ.				
84 Gaura glabra, Lehm	......	......	1	
85 Epilobium angustifolium, L	1	1	1	1
86 " palustre rar, lineare	1	1	1	1
87 " coloratum, Muhx	1	1	1	1
CACTACEÆ.				
88 Opuntia ——— (?)	......	......	1?	
UMBELLIFERÆ.				
89 Sanicula Marilandica, L	1	1	1	1
90 Heracleum lanatum, Michx	1	1	1	1
91 Thaspium trifoliatum, Gray	......	......	1	
92 Cicuta maculata, L	1	1	1	
93 Osmorrhiza brevistylis, D	1	1	1	1
94 Sium lineare, Michn	1	1	1	1
ARALIACEÆ.				
95 Aralia nudicaulis, L	1	1	1	1
CORNACEÆ.				
96 Cornus Canadensis, L	1	1	1	1
97 " stoloniefra, Michx	1	1	1	1
CAPRIFOLIACEÆ.				
98 Linnæa borealis, Gronov	1	1	1	1
99 Symphoricarpus occidentalis, Br	......	......	1	1
100 " racemosus, Michx	1	1	1	
101 Lonicera parviflora vas, Douglassii (?)	......	......	......	1
102 " involucrata, Banks	......	......	1	1
103 " parviflora. Lam (?)	1	1	1	
104 Viburnum pauciflorum, Pyl	......	1	1	1
105 " Opu'us, L	1	1	1	1
RUBIACEÆ.				
106 Galium triflorum, Michn	1	1	1	1
107 " boreale, L	1	......	1	1
VALERIANACEÆ.				
108 Valeriana pauciflorum, Hook	......	......	......	......
COMPOSITÆ.				
109 Nardosmia palmata, Hook	1	1	1	1
110 " sagittata, Hook	......	......	1	
111 Aster angustus, Torr & Gr	......	......	1	
112 " lævis, L }	......	N. B. 1	1	
113 " multiflorus, Ait	1	......	1	
114 " puniceus, L	1	1	......	
115 " ———, (?)	......	......	1	
116 Aster simplex, Willd	1	1	1	
117 " tenuifolius, L	1	......	1	
118 " cordifolius, L	1	1	......	1
119 " conspicus, Lindl	......	......	1	
120 " Lindleyanus, Hook	......	......	1	
121 Erigeron Philadelphicum, L	1	1	1	1
122 " glabellum, Nutt	......	......	1	
123 " acre, L	......	......	1	1
124 Solidago ——— ?	......	......	1	
125 " Canadensis, L	1	1	1	1
126 " rigida, L	......	......	1	
127 " serotina, Ait	1	......	1	1
128 " lanceolata, L	1	1	1	1
129 Grindelia squarrosa, Durral	......	......	1	
130 Bidens chrysanthemoides, Lag	1	......	1	1
131 Achillœa millefolium, L	1	1	1	1
132 " multiflora, Hook	......	......	1	
133 Artemsia dracunculoides, Pursh	......	......	1	
134 " Canadensis, Michx	1	......	1	

List of Plants, detected, &c.—*Continued.*

No.		Belleville.	Quebec.	Western Plains.	Lake Superior
	COMPOSITÆ.—*Continued.*				
	Artemisia biennis, Willd.	.....	1 N B	1	
	" frigida, Willd.	.....	.....	1	
	" discolor, Dougl.	.....	.....	1	
	" Ludoviciana, Nutt.	.....	.....	1	
	[illegible]	.....	.....	1	
	Antennaria dioica, L.	1	1	1	
	" Carpathica, R. Br.	.....	1	1	
	Senecio aureus, L.	1	1	1	1
	" lugens, Richard	.....	.....	1	
	Arnica Chamissonis, Less	.....	.....	1	
	Cirsium Drummondii, T. & G.	.....	.....	1	
	Troximon cuspidatum, Pursh	.....	.....	1	
	Hieracium Canadense, Michx.	1	1	1	1
	Nabalus racemosus, Hook.	.....	1	1	1
	[illegible] pulchellum, Nutt.	.....	.....	1	
	Helianthus strumosus, L.	1			
	Chrysopsis villosa, Nutt.	.....	.....	1	
	CAMPANULACEÆ.				
	Campanula rotundifolia, L.	1	1	1	1
	ERICACEÆ.				
	Vaccinium Canadense, Kalm	1	1	.....	1
	" cæspitosum, Michx.	.....	1 Lab	.....	1
	" Oxycoccus, L.	1	1	.....	1
	" Vitis-Idæa, L.	.....	1	.....	1
	" Myrtillus, L.				
	Arctostaphylos Uva-ursi, Spreng.	1	.....	.....	1
	Ledum latifolium, Ait.	1	1	.....	1
	Pyrola rotundifolia, L.	1	1	1	1
	" secunda, L.	1	1	.....	1
	" chlorantha, Swartz	1	1	1	1
	Moneses uniflora, Gray	1	1	.....	1
	PLANTAGINACEÆ.				
	Plantago major, L.	1	1	1	1
	PRIMULACEÆ.				
	Androsace septentrionalis, L.	.....	.....	1	
	Glaux maritima, L.	.....	.....	1	
	SCROPHULARIACEÆ.				
166	Pentstemon acuminatus, Dougl.	.....	.....	1	
167	Veronica Anagallis, L.	1	.....	.....	1
168	Orthocarpus luteus, Nutt.	.....	.....	1	
169	Castilleia pallida, Hunth	.....	.....	1	1
170	Rhinanthus minor, Ehrh.	.....	1	.....	1
171	Pedicularis bracteosa, Benth.	.....	.....	1	
172	" Grœnlandica, Retz.	.....	.....	1	
173	Melampyrum Americanum, Michx.	1	1		
	LABIATÆ.				
174	Mentha Canadensis, L.	1	1	1	
175	Monarda fistulosa, L.	1	.....	1	
176	Nepeta cataria, L.	1			
177	Dracocephalum parviflorum, Nutt.	1	.....	1	1
178	Stachys aspera, Gray	1	1	1	1
179	Lophanthus anisatus, Benth.	.....	.....	1	1
	BORAGINACEÆ.				
180	Cynoglossum Morisoni, D.	1	.....	1	1
181	Mertensia paniculata, Don.	.....	.....	1	1
	POLEMONIACEÆ.				
182	Collemia linearis, Gray	.....	N. B. 1	1	1

List of Plants, detected, &c.—*Continued.*

	Belleville.	Quebec.	Western Plains.	Lake Superior
GENTIANACEÆ.				
183 Halenia deflexa, Griseb	.....	1	1	
184 Gentiana acuta	......	1	1	1
APOCYNACEÆ.				
185 Apocynum androsæmifolium, L	1	1	1	
186 " cannabinum, L	1	1	1	1 1
ASCLEPIADACEÆ.				
187 Asclepias verticillata, L	......	......	1	
CHENOPODIACEÆ.				
188 Chenopodium album, L	1	1	1	
189 " glaucum, L	......	......	1	1
190 Blitum capitatum, L	1	......	......	
191 Salicornia herbacea, L	......	N. B. 1	1	1
192 Sueda maritima, Dumor	......	N. B. 1	1	
POLYGONACEÆ.				
193 Polygonum amphibrum, L	1	1	1	
194 " aviculare, L	1	1	1	1
195 " convolvolus, L	1	1	1	1
196 " tenue, Michx	1	......		1
197 Rumex salicifolius, Weinm	......	N. B. 1	1	
198 " maritimus, L	1	......	1	1
199 " longifolius, DC				
ELÆAGNACEÆ.				
200 Shepherdia Canadensis, Nutt	1	1		
201 " argentea, Nutt	......	......	1	1
202 Elægnus argentea	......	......	1 1	
SANTALACEÆ.				
203 Comandra umbellata, Nutt	1	1	......	1
CALLITRICHACEÆ.				
204 Callitriche verna, L	1	1	1	1
EMPETRACEÆ.				
205 Empetrum nigrum, L	......	1	.....	1
URTICACEÆ.				
206 Urtica gracilis, Ait	1	1	1	1
MYRICACEÆ.				
207 Myrica Gale, L	1	1	......	1
BETULACEÆ.				
208 Betula alba var, populifolia, Sp	......	1	1	
209 " papyracea, Ait	1	1	.....	1
210 " pumila, L	1	1	1	
211 " occidentalis, Hook	......	......	1	
212 Alnus viridis, DC	......	1	1	1
213 " incana, Willd ?	1	1	1	1
SALICACEÆ.				
Many Willows.				
214 Populus tremuloides, Michx	1	1	1	1
215 " balsamifera, L	1	1	1	1

List of Plants, detected, &c.—*Continued.*

	Belle-ville.	Quebec.	Western Plains.	Lake Superior
CONIFERÆ.				
nksiana, Lam. ?	......	1	1	1
ra, Poir.	1	1	......	1
a, Michx	1	1	1	1
samea, Marsh	1	1	......	1
nericana, Michx.	1	1	1	1
s communis, L.	1	1	......	1
Sabina var procumbens, Pursh.	......	......	1	1
LEMNACEÆ.				
minor, L.	1	1	1	
trisulca, L.	1	1	1	
TYPHACEÆ.				
atifolia, L.	1	1	1	1
ium simplex var.	1	1	1	1
NAIADACEÆ.				
geton pectinatus, L.	1	1	1	1
perfoliatus, L.	1	1	......	1
ALISMACEÆ.				
Plantago, var. Americanum, Gv.	1	1	......	1
in palustre, L.	1	1	......	1
maritimum, L.	1	1	1	1
ia variabilis, Engl.	1	1	1	1
ORCHIDACEÆ.				
ria hyperborea, R. Br.	1	1	1	1
obtusata, Rich.	1	1	1	1
hes Romanzoviana, Chap.	1	1		
rhiza innata, B. Br.	1	1	......	1
LILIACEÆ.				
pus amplexifolius, D.	......	1	......	1
na racemosa, Desf.	1	1	......	1
stellata, Desf.	1	1	1	1
trifolia, Desf.	1	1	1	1
bifolia, Hier.	1	1	1	1
stellatum, Nutt	......	......	1	
Schænoprasum, L.	......	1	......	1
JUNCACEÆ.				
alpinus var. insignis, Vill	1	1		
Balticus, Det.	1	1	1	1
bufonius, L.	1	......	1	
Canadensis, var.	1	1	......	1
filiformis, L.	1	1	......	1
nodosus, L.	1	1	1	1
tenuis, Willd.	1	1	1	1
———— ?	......	......	......	......
CYPERACEÆ.				
aris palustris, R. Br.	1	1	1	1
acicularis, R. Br	1	1	1	1
s atrovirens, Muhl.	1	1	1	1
riparius, Presl	1	1	1	1
maritimus, L.	......	N. B. 1	1	
———— ?	......	......	1	
orum vaginatum, L.	1	1		
adusta, Boott	1	1	1	1
alpina, Swartz	......	......	......	1
aquatilis, Wahl	1	1	1	1
arctica, Boott	1	1	......	1
aristata, R. Br	1	1	1	1
canescens, L.	1	1	......	1
canescens var. vitilis	1	1	......	1
Deweyana, Schw	1	1	......	1

List of Plants, detected, &c.—*Concluded.*

	Belleville.	Quebec.	Western Plains.	Lake Superior
CYPERACEÆ.—*Continued.*				
267 " gynocrates, Worms	1	1		
268 " retrorsa, Schw	1	1	1	1
269 " scoparia, Schk	1	1	1	1
270 " straminea, Schk	1	1	1	1
271 " stricta, Lam	1	1	1	1
272 " tenella, Schk	1	1	1	1
273 " trisperma, Dew	1	1	.....	1
274 " utriculata, Boott	1	1	1	1
275 " vaginata, Tausch	1	1	.....	1
276 " virescens, Muhl, ?	.....	.....		
277 " festiva, Dewey	.....	.....	1	
278 " Douglasii, Boott	.....	.....	1	
279 " marcida, Boott	.....	.....	1	
GRAMINEÆ.				
280 Alopecurus aristulatus, Mx	1	1	.....	1
281 Phleum patense, L	1	1	.....	1
282 Vilfa cuspidata, Torr	.....	.....	1	
283 Spartina polystachya, Muhl	.....	.....	1	
284 Agrostis scabra, Willd	1	1	1	1
285 Cinna arundinacea. L	1	1	1	1
2 6 Muhlenbergia glomerata, Trin	1	1	1	1
287 Calamagrostis, Canadensis, Beauv	1	1	1	1
288 " stricta, Trin	.....	.....	1	1
289 Stipa Richardsonii, Link	.....	.....	1	1
290 " membrancea, Pursh	.....	.....	1	
291 Glyceria nervata, Trin	1	1	1	1
292 " aquatica, Smith	1	1	1	1
293 " maritima, Wahl	.....	1	1	
294 " fluitans, R. Br	1	1	.....	1
295 " arctica, Hook, ?	.....	.....		
296 Poa cœsia, Smith	1	.....	1	1
297 " serotina, Ehrh	1	1	1	1
298 " pratensis, L	1	1	1	1
299 Festuca ovina, L	1	1	1	1
300 " duriuscula,; Hook	1	1	1	1
301 Bromus ciliatus, L	1	1	1	
302 Triticum repens, L	1	1	1	1
303 " caninum, L	1	1	1	1
304 Brizopyrum spicatum, Hook	.....	.....	1	
305 Phragmites communis, Trin	1	1	.....	1
306 Hordeum jubatum, L	.....	1	1	1
307 Elymus Canadensis, L	1	1	1	1
308 Danthonia spicata, Beauv	1	1	1	1
309 Avena striata, Michx	1	.....	1	1
310 Aira cæspitosa, L	1	1	.....	1
311 Phalaris arundinacea	1	.....	1	1
312 Deschampsia cæspitosa, Beauv	.....	.....	1	
313 Catabrosa aquatica, Beauv	.....	.....	1	
314 Festuca borealis, Hook	.....	.....	1	
315 ————	.....	.....	.....	
EQUISETACEÆ.				
316 Equisetum arvense. L	1	1	1	1
317 " sylvaticum, L	1	1	1	1
318 " variegatum, Schl	1	1	1	1
319 " scirpoides, Michx	1	1	.....	1
FILICES.				
320 Asplenium filix-fœmina, Bernh	1	1	.....	1
321 Phegopteris Dryopteris, Fee	1	1	.....	1
322 Aspidium spinulosum, Swz. var	1	1	.....	1
323 Botrychium lunarioides, Milde	1		1	1
LYCOPODIACEÆ.				
324 Lycopodium lucidulum, Mx	1	1	.....	1
325 " annotinum, L	1	1	.....	1
326 " clavatum, L	1	1	.....	1
327 " complanatum, L	1	1	.....	1
328 Selaginella rupestris, Spring	1	1	1	1
Totals	213	223	252	228

CLIMATE, SOIL AND SUITABILITY FOR SETTLEMENT.

The climate of a country is not wholly due to its altitude or latitude. The wind currents which pass over its surface, or if the country be an insular one, the currents that lave its shores exert a most important influence. This being an acknowledged fact, we should not decide too hastily on the climate of that part of Canada lying along the eastern slope of the Rocky mountains. From data furnished by Captain Palliser's reports of his explorations, it is shown that Jasper's House has a higher winter temperature than Edmonton; while the latter has a much higher one than that of Carleton, which lies three hundred miles farther to the east. From a parity of reasoning can we not show that a higher summer temperature is found along the base of the mountains than is found out on the plains?

The climate in the neighborhood of Fort Edmonton is favorable to the growth of all kinds of grain, except maize. So also is that of Big Lake, or St. Albert's Mission, nine miles farther to the north. In both localities, I saw wheat, oats and barley, of excellent quality, and much taller than it is seen in Ontario. The season of 1872 was very unfavorable, owing to the almost constant rains, and consequent chillness of the atmosphere. Yet the crops around Edmonton all came to maturity, except a very little late wheat, which was frozen on the 25th August. The difference between the summer heat of 1871 and 1872 can be better understood by the fact that the barley of the H. B. C. was ripe on the 12th August of the former year, while it was not fit for the sickle until the 26th last year. Fall wheat has never been tried, but there is no reason why it should not succeed, as the ground is covered with snow all the winter, and the ground is never so wet as to heave it out in spring when the winter is breaking up.

From data furnished by Captain Palliser's report, and others at Fort Edmonton, it seems that ploughing commences about the 10th of April on an average, and wheat is sown by the end of the month. Mons. Bourgeau found many plants in flower during April; more than are generally found in Eastern Canada in that month. He records observing an Anemone [*Anemone patens*] in flower on the plains, April 11th, and the frogs croaking the same evening. During twenty years in Ontario I never observed our first spring flower [*Hepatica triloba*] as early as that except twice.

The ground freezes up about the last of October, though there is generally much mild weather after this. While we remained at the fort the thermometer rose to 72 in the room, so that it was over 80 in the sun. This was about the first of September.

Mr. Lewis Chartellain, whom I saw at Big Lake, had wheat, barley, oats carrots, potatoes, turnips and other vegetables growing there. All, except the wheat and barley, were on ground which was broken up for the first time last spring. He says that with decent farming and early varieties of grain, wheat would be always a sure crop, as nothing but frost ever injured it. Stock and grain-raising will be the employment of the half-breeds when the buffalo fails, but not till then, as it is not in their nature to work until necessity compels them.

At Lac La Nun, 50 miles from Edmonton, and on the height of land, potatoes and barley had been tried last year, but a frost in July had cut them off.

At Fort Assiniboine, on the Athabasca, no farming is done at present, owing to the apathy of the person in charge. He says that barley and vegetables were formerly raised, but that now summer frost would cut them off. Much of the land between the Athabasca and Pembina rivers is of the very best quality; but agricultural products have never been raised.

Between the Athabasca and Little Slave Lake there is any quantity of good pasture land, but none that could be called farming lands, owing to their altitude and inclination. Summer frosts are certainly of constant occurrence, but still blueberries [*Vaccinium Canadense*] ripen well. Collected great quantities of them between the 9th and 15th of September.

Some farming is done around Slave Post, on the north western end of the Lake; but it is of the very rudest description, and year after year on the same spot. Both barley and potatoes are raised; the latter instead of being an early variety is a miserable winter one. It has been so long in the country that no one could tell when it was introduced. The same variety is raised at Dunvegan and St. John. At Dunvegan, made inquiries about its introduction, and was told that it might have come in with *Noah. I thought it might.* Mr. McGillvery, whom I met at the Pembina, told me that their barley was never injured by frosts, as it was always ahead of it. This year it was ripe by the 12th of August. Wheat has never been tried, but the Padre said the climate was just as warm as at Lac La Biche, where they raise large quantities of it. From my own observations, I am satisfied that wheat would succeed, as I think there is a higher summer temperature here than at Edmonton. Not more than ten acres of land have ever been cultivated here, the people depending on the products of the chase and the fishery for subsistence. Great quantities of white fish are taken in the lake, and the people have no dread of starvation.

Made an excursion in the vicinity of the post and observed 184 species of plants. Not one of these indicate a cold climate.

132 of this number grow in the vicinity of Belleville.
18 of the remainder were detected at Lake Superior.
34, the remainder, were observed on the Saskatchewan.

The Lake Superior plants were.

Ranunculus Cymbalaria,
Ribes oxycanthoides,
Parnassia parviflora,
Lonicera involucrata,
Viburnum pauciflorum,
Erigeron acre,
Cirsium Pitcheri?
Vaccinium Vitis-Idœa,
" cœspitosum,

Vicia Americana,
Mertensia paniculata,
Rumex salicifolius,
Polygonum articulatum,
Streptopus amplexifolius,
Hordeum jubatum,
Stipa Richardsonii,
Calamagrostis stricta,
Nabalus racemosus.

As far as I could judge the whole of the land, from Little Slave Lake, to Smoky River, and on up to the base of the mountains, is of the very best quality. As I did not travel over the whole tract, I cannot say from actual observation that this is so, but what I saw [at least 200 miles in length] of it was the best land I had seen anywhere. There was neither marsh nor swamp to any extent, but one wide extended expanse of rich soil, altogether devoid of stones. My observations bear out all that has been said of the fertility of the land along Peace River, though I was much disappointed to find scarcely any signs of farming at Dunvegan. Two small fields seem to be all that have ever been cultivated there—one for barley, the other for potatoes, and *vice versa*. This goes on from year to year. The same seed is probably used year after year, as it certainly is in the case of the potato. Game is still too plentiful for much attention being paid to agriculture. What little is done is on a terrace about 30 feet above the river. One little field is cultivated on each side of the stream, which is over 400 yards wide at this point.

At Dunvegan, and between it and St. John, I particularly noted all the various species of plants, whether herbaceous or otherwise, and noticed a marked similarity between them and those found at Edmonton and Slave Post. The whole number observed was 212 species.

138 of these grow in the vicinity of Belleville.
19 were detected at Lake Superior.
52 were observed on the Saskatchewan.
3 had not been seen before.

The three latter were a Cactus ! ! (*Opuntia Missouriensis ?*) *Vaccinium Myrtillus*, and *Sedum Rhodiola*.

It will be seen by this that the region of country along the Peace River has more of the prairie vegetation than the wooded country at Slave Lake. Its flora indicates both a drier and warmer climate than they have at the latter place. The prairie vegetation is almost identical with that of Edmonton, except a few eastern species. This being so, can we not, with justice, say that what they raise at Edmonton can likewise be raised on the plains bordering Peace River. Although summer frosts are not unknown at Dunvegan, they do little if any harm. It is very probable that no harm would be done by them on the level country outside of the river valley, owing to the exemption of it from the producing cause. The Padre at Dunvegan furnished a written statement to the effect that there were no spring frosts ; and when a summer frost did occur, it was caused by heavy rain, about the time of the full moon in August, followed by clear still nights. Now this is precisely the cause of our summer frosts, which do considerable local damage every year. Whenever there is a circulation of air, there is no frost, as was pointed out to me by Mr. Kennedy, the gentleman in charge of St. John. A corner of his potato patch was killed this year, but it was sheltered from the wind, while that exposed to the air was left untouched. Both Mr. Horetzki and myself noticed that the temperature during October was lower in the valleys of rivers than on the level country above, and very probably this is the case during the summer.

That the Peace River country has an exceptional climate, any one seeing it must confess. While we were travelling through it the constant record was, " warm sunshine, west wind, balmy atmosphere, and skies of the brightest blue." Even as late as the 15th of October, the thermometer was 48° at daylight, and 61° in the shade at noon. Within the foot hills of the Rocky Mountains, I picked up three species of plants in flower as late as the 26th of the same month. These facts, and many others that could be adduced, show conclusively that there is an open fall ; and the united testimony of the residents makes it clear that spring commences before the 1st of May. There must likewise be a warm summer, as the Service Berries (*Amelanchier Canadensis*) were gathered fully ripe as early as the 15th July, last year, by the miner we engaged at Edmonton ; same berries ripening at Belleville about the 10th of the same month. These berries are so sweet that we preferred them to currants in our pemican.

From all the observations I made, both in respect of soil and vegetation, I am satisfied that the whole country between Slave Lake and the Rocky Mountains is a continuation of the prairie. The mountains we crossed between Fort Assiniboine and Slave Lake would therefore be a spur of the Rocky Mountains, and Sir John Richardson's remark that there was a level country all the way from the English River or Portage La Loche to Little Slave Lake, would confirm this opinion. He even goes farther, and on page 364 of his work says that : " From Methy Portage westward, the country, though deeply furrowed by river courses and ravines, and more or less thickly wooded, partakes so much of a prairie character that horsemen may travel over it to Lesser Slave Lake and the Saskatchewan." If this opinion be correct, and I have no reason to doubt it, we can then assert with truth that the prairie country extends all the way from the lower Saskatchewan by Lac La Biche across the Athabasca to Slave Lake, and thence to the mountains. Here then is a strip of country over 600 miles in length, and at least 100 in breadth, containing an area of 60,000 square miles, which has a climate no way inferior to that of Edmonton. I know that many doubts will be cast on the truthfulness of this statement, but from a careful perusal of many *published* tables of the climatology of the district in question and my own observations, I can come to no other conclusion than this, that the day is not far distant when the most sceptical will believe even more than I now assert. The summer frosts are due to radiation, and whether the settlement of the country will have any effect in lessening them, is a matter of speculation. It has always been so in Ontario, that summer frosts have ceased as the country became opened up. May this not be the case in Rupert's Land and Peace River country ?

Regarding the quality of the soil throughout the entire region, my note-book is unvarying in its testimony. I took every opportunity to examine the soil, and always found it deep and fertile. It was principally clay loam, but had much the appearance of the *intervale* lands along streams in Ontario. Its average depth, where sections were exposed, was five feet, but owing to the clay subsoil it was practically inexhaustible. Days would elapse without seeing a stone except in the beds of streams, and swamps were unknown on the level country along Peace River.

I am not prepared to say what is the cause of this exceptional climate, but one thing is known, that the west wind, summer or winter, always brings warm weather. Now, can it be possible that this wind retains its heat while crossing the mountains, and gives warmth on the eastern side, while the same parallels on the west side of the mountains are not benefited by it? I am more inclined to the opinion that it is caused by the settling down, as it were, of a current of warm air coming from the south, something analogous to the gulf stream. It is a well known fact that this belt of warm air extends all the way down the Mackenzie, as wheat can be raised as far north as 65°. If the wind comes from the Pacific, it is a new fact in physical geography, for the eastern side is certainly warmer than the west at the base of the mountains.

The following table shows the temperature of Belleville, as taken by Alexander Burdon, Esq., Station Observer, during the ten days between the 10th and 19th of October, 1872, and the observations made by myself when passing over the portage between Dunvegan and St John, during the same period.

Belleville being lat. 44° north, and 77.25 west long.; while Dunvegan is in lat. 56°, and about 118° west long.

BELLEVILLE.					DUNVEGAN TO ST. JOHN.			
	7 a. m.	1 p.m.	9 p m.	Max.	7 a m.			
Oct. 10th	46.2	50.7	40.0	58.0	23.00		47.00	9.00 p. m.
" 11th	33.5	42.7	33.2	44.2	37.00		53.00	7.30 p. m.
" 12th	33.3	44.0	48.0	48.0	32.00	Noon in shade. 70.00	37.00	6.00 p. m.
" 13th	No Observations.				28.00	1 p m 73.00	38.00	8.00 p. m.
" 14th	42.7	48.0	38.9	50.5	30.00		49.00	8.00 p. m.
" 15th	33.6	43.7	40.0	50.0	48.00	Noon. 61	40.00	7.45 p. m.
" 16th	41.7	45.7	37.2	48.3	29.00		47.00	8.45 p. m.
" 17th	32.1	45.6	51.7	51.7	41.00		49.00	8.00 p. m.
" 18th	41.8	53.3	43.4	54.4	43.00		31.00	8.00 p. m.
" 19th	41.4	44.6	33.3	46.0	26.00	1.45 p.m. 43.00	34.00	8.30 p. m.
Average..........	38.5	46.5	40.6	50.1	33.7		42.5	

It will be seen by the above table that there were only four degrees difference between the temperature of Belleville at 1 p. m. and Dunvegan at about 8 p. m., while the temperature at noon could not have been less than 60° on an average.

In a pamphlet published last year, at Ottawa, by Malcolm McLeod, Esq., there is a table given, comparing the summer temperature of Dunvegan with that of Toronto; and while the average of the latter for six months is 54.87, the former is 54.44, or only half a degree lower, though Dunvegan is more than twelve degrees farther north. This shows that 1872 was not an exceptional year.

FACILITIES FOR LINES OF COMMUNICATION.

I shall only say a very few words on this subject, and in doing so, I can only be expected to give the impression which I formed, as I travelled from point to point. Between Edmonton and Fort Assiniboine, the country does not appear difficult, and I have no doubt a good route for a road or Railway could be obtained. The trail between the Athabasca and Little Slave Lake led through a very difficult country, and one that would be of no use for the purposes of settlement. From Slave Lake to the Rocky mountains there are no difficulties whatever except the crossing of the Smoky River and some minor streams.

Both the Beaver and Carrier Indians report a low and wide pass through the mountains, at the head of the Epinette. There can be no doubt about a pass of some kind, as the above river, I am satisfied, comes from the west side of the mountains. It was the only river we saw that was swollen by the September rains that had such an effect on Peace River, and which rains fell to the west of the mountains. From the size of the river [150 yards], and its depth, it must have gathered its waters from a considerable extent of country, and I therefore conclude that it drains that section of the mountains between Smoky River and the Peace, and enters the mountains in precisely the same way as the Athabasca or Saskatchewan. If this be the case, its source will probably be found not far from the head of the Peace river itself, and in this quarter I think that a passage across the mountain may fairly be looked for. Fully as far south as lat. 55°.

The Peace River valley, through the mountains, as far as I can judge, presents no very serious difficulties to the construction of either a railway or waggon road. As I have shown in another part of this report, a bridge could be thrown across the river about eight miles below Hudson Hope, and the road carried up the left bank of the river all the way through the mountains. The worst part of Peace river is nothing like the canons of the lower Fraser. It may be described as simply a narrowing of the valley by the mountains approaching each other until there is barely room for the river to find a passage. The right bank would be much more difficult for road construction, as the mountains rise almost from the water for a number of miles. Having passed down the Fraser and over the Nevada, since seeing Peace river, I can say *decidedly* that there is no comparison between them. The nearest approach to Peace River, in appearance, is that part of the Fraser between Fort Hope and Harrison river, where no canons exist, and to give a correct idea of the extent of the chief difficulties on Peace River, I may add that they do not extend over more than about 6 miles.

After the mountains are passed, there is nothing in the general appearance of the country to show that a road could not be built. The whole upper part of British Columbia is a plateau, with low ranges of mountains or rocky hills running through it. These are not continuous, but isolated, and have no very uniform direction. The general character of the plateau is either level, sandy tracts, covered with Banksian pine, or gravelly ridges, with a sprinkling of Aspen or Douglas pine.

I have abstained from speaking of the snow fall—the general altitude of the country—the information obtained from the Indians, and other matters contained in the letter of instructions with which you furnished us, as Mr. Horetzki was specially requested to attend to those subjects, and I believe he has procured sufficient data on all these points.

Had it been possible to have traversed the country in summer, when the flora was in such a state that I could have brought back specimens of the various species, my report on the botanical productions would have been far more complete and satisfactory. When all the collections arrive, however, I will make out a complete catalogue of all the species observed between lake Superior and the Rocky mountains, and endeavor to show, by comparison with the floras of other regions, the actual climatic relations which exist between them.

I have the honor to be,
Sir,
Your Obedient Servant,
JOHN MACOUN.

APPENDIX D.

GENERAL INSTRUCTIONS TO THE STAFF.

First.—To Engineers in charge of Parties.

1. The gentleman placed at the head of a party will be required to take general charge of it, and the Chief Engineer will look to him for the proper and faithful execution of all instructions, whether general or special, which may be given from time to time, as well as for the maintenance of proper discipline in the party.

2. Every member of the party will be under the Engineer in charge, and must obey his orders. The Commissariat Officer in charge of the transport of provisions will consult with and be advised by the Engineer in charge, and in the absence of the former, the packman will obey the orders of the latter.

3. When the Engineer in charge finds it necessary to leave the party, or in the event of illness, he shall nominate the person to act in his place for the time being; in the event of his failing to do so the Transit-man shall take charge.

4. Arrangements will be made for forwarding supplies to a general depot at or near the point of commencement of each Division of the Survey, and when practicable, to certain intermediate points; this will be done by the Commissariat Department, but the Engineer in charge must, before starting for his field of operation, obtain a complete list of all supplies intended to be forwarded, and if any article appears to him to be wanting or superfluous, or if any change in the proposed arrangement respecting the mode of supply appears advisable, he shall at once confer with the Commissariat Officer, and before leaving for the survey he shall arrive at a perfect understanding with respect thereto.

5. The Commissariat Officer is instructed to procure and forward the very best of each article required, and to use every means in his power to maintain a sufficient supply of provisions and stores. The Engineer in charge must, however, look sufficiently far ahead with reference to the movements of his party, to be able to advise that officer as to the nature and quantity of stores required, and the place where they must be delivered, and there must be a clear and distinct understanding between them that they will be delivered at the time and place required. The Engineer will also see that proper care is taken of the supplies, and that there is no waste.

6. As the season for field operations is limited, the Engineer in charge is expected to see that every member of his party performs his duty with diligence, and that every effort is made to carry out the whole of the work in a satisfactory manner.

7. Each exploring party shall be designated by a letter of the alphabet, and all articles of equipment, supplies, books, papers and records, belonging to the party shall be marked with and known by that letter.

8. In conducting the survey the Engineer of a party is expected to be at its head every day, exploring in front, and to the right and left of the line, in order to see what obstructions may be in the way of the same, and if serious, deciding as to the best manner of avoiding them.

9. It is not expected that the first survey through wooded districts will, as a rule, be the best position for the railway; it will, however, be the aim of the Engineer in charge to have the "Transit Line" not very far distant from a practicable railway line. The "Transit Line" on which the measurements are taken will form a base on which to project an approximate section, and the Engineer in charge, by noting the features of the country on both sides of the line, will be able to make an approximate section as the survey proceeds.

10. In many cases it will be desirable for the Engineer in charge while making his daily explorations, to take barometric elevations of the ground, noting by estimation the approximate position of the points of observation in relation to the "Transit Line." These elevations should be reduced afterwards to the datum of the survey, and marked upon the plan in their proper position. This, as well as the general features of the country, should be marked upon the plan every day, while the whole is fresh in the memory. The barometric elevation will answer for rough cross sections, and be useful in determining on the plan, the position of the approximate location line, and also in compiling an approximate section of the same.

11. The engineer in charge must have two barometers, one to be carried by himself, the other to hang in camp; the cook, if moderately intelligent, can, in a short time, be instructed to observe and record its readings, and he should do so regularly at every hour of the day. By this means the Engineer in charge, (who will note the time when his own observations are taken) will be able to correct roughly all his observations, ascertain by comparison the height of each point above the camp (this being known), and thus be enabled to reduce all to the level above the datum of the survey. Barometers will be furnished by the Government.

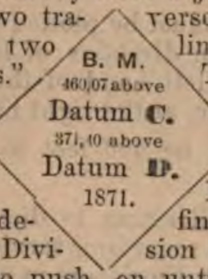
12. The Engineer in charge will find it of great service while exploring, to carry with him light steel climbers, made to enable him to climb a tree with facility. By this means he will frequently be enabled to obtain a good knowledge of the topography of the surrounding country, and take such general observation and bearings as may be useful in directing the survey. A pair of climbers will be furnished with the stores for each party.

13. It may frequently be necessary to move camp when circumstances will render the available force of packmen inadequate for this duty, at such times it will be proper and expedient for all, or as many members of the Staff as the Engineer in charge may direct, to assist in this work. The Engineer in charge will, however, be governed by circumstances, and use his best judgment in having this done in such a manner as will least delay the survey.

14. Instructions for the instrumentalists are printed on the first page of each of the "Field Books," (copies accompanying this), and the undersigned will look to the Engineer in charge to see these general instructions carried out.

15. It is important that observations of the pole or some other star should occasionally be made (say once in every ten miles) when the weather will admit of its being done, in order to check the traverse of the line. The latitude of certain points should also be determined approximately, whenever a favourable opportunity occurs, by means of an observation of either the upper or lower transit of the pole-star, or otherwise; the Engineer in charge taking care, however, that both these objects are effected in such a manner and at such times as not in any way to delay the progress of the surveying party.

16. At the starting point and termination of each division of the Survey, the Engineer in charge will see that conspicuous "Reference Stakes" and "Bench Marks" are established with all necessary information respecting the Survey and adopted datum, distinctly written thereon. When two Divisions of the Survey form a junction, the two Engineers in charge will see that the two traverses are properly connected, and the angle formed by the two lines, measured and entered in each of the "Field Books." The levels must also be connected, and a common "Bench Mark" established, with the elevation of the same above the two respective datums clearly marked thereon, thus:—



In the event of one party arriving at the generally defined termination of a Division before the party on the next Division has reached that point, it will be the duty of the former to push on until a connection is made.

17. Whenever an opportunity occurs, once a fortnight if practicable, the Engineer in charge shall forward to the Head Office a traced copy of the plan and section, shewing, with full details, the amount of work done to date.

18. As it is probable that there will be occasions when each member of a party will have to carry his personal baggage, this should be reduced to the smallest weight possible. Keeping this in view, the following is all that is considered necessary to form an outfit, viz.:—2 pair of pants, 2 coats, 3 flannel shirts, 3 pair of drawers, 6 pair of socks, 1 pair of mitts, 2 pair of strong boots or shoepacks, 1 towel, 1 brush and comb, and a few other small articles; the whole personal outfit need not exceed 30 pounds. The Engineer in charge will, upon his party arriving at the end of steam

boat navigation, see that the personal baggage belonging to members of his party is reduced to the above. Strong canvass bags, sufficiently large to contain the outfit and one pair of blankets (to be supplied by the Government), will be provided for each member of the party.

19. Except in special cases, which will be determined by the undersigned, it is desirable to limit the number of fire arms in each party to one rifle and one double barrelled gun.

20. It may be necessary, during the progress of the survey, to forward special instructions to the Engineer in charge of a party; for this and other reasons, that officer will take special care that whenever he changes his camping ground, a notice is distinctly written (upon a tree or elsewhere, in such a conspicuous position that it can be readily seen by anyone passing along the line) containing the following, viz.:—

1st. The distinguishing letter of the Division of the Survey.
2nd. The number of the camp.
Each camp should be numbered consecutively from the beginning of the division.
3rd. The date of the removal of the camp.
4th. The probable direction and distance to the next camping ground.
5th. The name of the Engineer in charge of party.

21. All field notes must be clearly and distinctly made in pencil on the spot, no additional notes should be entered with the original notes after the day on which the latter are written. Field notes should not be inked or changed in any way; copies of them may be made in ink and reduced levels entered in ink.

22. All plans and profiles must be plotted so that the end of the survey line (whatever may be the direction of local sinuosities) nearest the Pacific Ocean shall be at the left hand of the paper, and the end of the survey line nearest the Atlantic, at the right hand.

23. Horizontal scales must be 400 feet to an inch; Vertical scales 30 feet to an inch.

24. Without in the least desiring to dictate on the subject, attention is requested to the suggestions regarding service on Sundays, which have been placed in the hands of the Engineers in charge of parties.

25. The Engineer in charge will be furnished with a diary and note book, in which he will enter daily, a record of the progress of survey and every thing relating thereto.

Second.—Instructions to Transit-men.

The object of the survey about to be undertaken is to secure a contimous chain of instrumental measurements through the country, as near as possible to the shortest and most practicable route for railway construction. The information obtained by means of the survey, should be fully and carefully put on record in such a way, that no difficulty will be experienced hereafter by any one in understanding it perfectly. It is important, therefore, that uniformity of system in making measurements and preserving records should be adopted throughout, and with that object in view, the undersigned requests attention to the following:—

1. The first entry in the "Field Book" each morning should be the date, and the name of the person acting as "Transit Man."

2. The Transit man is requested to make full notes as he proceeds, of the character of the country, lakes, timber, &c., on both sides of the line.

3. All field notes must be clearly and distinctly made in pencil on the spot, no additional notes should be entered with the original notes after the day on which the latter are written. Field notes should not be inked or changed in any way; copies of them may be made in ink and reduced levels entered in ink.

4. All plans and profiles must be plotted so that the end of the survey line (whatever may be the direction of local sinuosities) nearest the Pacific Ocean shall be at the left hand of the paper, and the end of the survey line nearest the Atlantic at the right hand.

5. Horizontal scales must be 400 feet to an inch; Vertical scales 30 feet to an inch.

6. The Transit is to be used, because no reliance can be placed on the compass in passing through a mineral region.

7. In certain cases, however, where local magnetic attraction does not exist, the Compass may be substituted for the Transit.

8. When a change in the direction of the line is made the angle to the right or left must be carefully noted.

9. The chaining must be as correct as possible, a stake being driven at the end of every hundred feet, and the number of chains from the starting point of the Division marked thereon.

10. At every change in the direction of the line a larger stake should be driven, having the distance marked thereon.

11. The line must be cleared sufficiently to admit of levels being taken.

12. At the commencement of the survey it is desirable that observations should be taken to establish the latitude and determine the angle which the line to be surveyed makes with the true meridian; the latter should be done once in every ten miles or once a week if possible, (in order to check the traverse), and the former when practicable; these observations should be taken at such times as will not interfere with the progress of the survey.

13. The chaining will be noted regularly from the bottom of the page upwards, each hundred feet stake driven being noted on a separate line, the space on each side of the column for distances being used for such notes and sketches to the right and left of the line as may be necessary in order to give a general idea of the country.

14. Note every stream and river crossed, its size, direction, probable maximum volume, and any peculiarities which it may seem to possess.

15. Every member of the party will be under the Engineer in charge l must obey his orders. The Commissariat Officer in charge of the nsport of provisions will consult with and be advised by the Engineer charge, and in the absence of the former the packmen will obey the lers of the latter.

16. In the event of the absence or illness of the Engineer in charge, d unless he shall otherwise determine, it will be the duty of the Transit-an to take charge of the party and direct its movements.

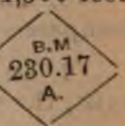
Third.—Instructions to Levellers.

The object of the Survey, &c., &c. (See Instructions to Transit-men.)

1. In keeping field notes the first duty every morning will be to enter he date and the name of the Leveller, whose notes are to be recorded.

2. All field notes must be clearly and distinctly made in pencil on the spot, no additional notes should be entered with the original notes after the day on which the latter are written. Field notes should not be inked or changed in any way; copies of them may be made in ink and reduced evels entered in ink.

3. Bench marks should be regularly established about every 1,500 feet apart, and the elevation above datum written thereon thus:— the letter underneath being the distinguishing mark of the particular division of the survey and of the party. Each Bench-mark must be described in the column of remarks.



4. Note every stream and river crossed, its size, direction, level of surface, difference of level between high and low water if practicable, and any peculiararities which it may seem to possess.

5. All plans and profiles must be plotted so that the end of the survey line (whatever may be the direction of local sinuosities) nearest the Pacific Ocean shall be at the left hand of the paper, and the end of the survey line nearest the Atlantic, at the right hand.

6. Horizontal scales must be 400 feet to an inch. Vertical scales 30 feet to an inch.

7. Every member of the party will be under the Engineer in charge, and must obey his orders. The Commissariat Officer in charge of the transport of provisions will consult with, and be advised by the Engineer in charge, and in the absence of the former the packman will obey the orders of the latter.

8. The Engineer in charge will name the person who is to take charge of the party during his temporary absence or illness, in the event of his failing to do so the Transit-man shall take charge.

SANDFORD FLEMING,
Engineer-in-Chief.

Ottawa, 24th May, 1871.

APPENDIX E.

Progress Report, on the Surveys, for 1872, in British Columbia, by Marcus Smith, Esq.

OTTAWA, May 1st, 1873.

SANDFORD FLEMING, Esq.,
Engineer in Chief,
Canadian Pacific Railway.

SIR,—I have the honor to submit the following Report on the Exploratory Survey for the Canadian Pacific Railway, made during the past year in the Province of British Columbia.

My position and duties in regard to these surveys, and the lines to be explored, are clearly defined in your letter to me, of March 30th, 1872, offering me the appointment, and that of May 8th, received on my way to British Columbia, of which the following extracts give the substance, viz:—

"In the event of your accepting the position offered it will be expected "that you will proceed to British Columbia with as little delay as possible "and immediately on your arrival take under your special charge the sur-"veys, deemed necessary, between Victoria, Vancouver Island, Bute Inlet "and the Fraser river; at the same time assuming general charge, as my "principal Resident Assistant, of all the other surveys now going on in "British Columbia." * * * * * * * * *

"I may state to you generally that the great object of the important "service upon which you will be engaged is to determine—approximately "at all events—the most practicable line or lines from Tête Jaune Cache "to such point or points on the Pacific coast, as may be considered most "eligible for the terminus of the Railway."

"You will see Mr. George Watt, commissariat and paymaster at "Victoria; his duties are, as you are aware, in connection with the furnish-"ing of supplies and the payment of accounts.

"The expenditure in British Columbia has already been great—per-"haps unavoidably so—but I must impress upon you the importance of "seeing, as far as in your power, that no expenditure is incurred that cannot "be fully justified by the circumstances."

In accordance with these instructions, as soon as I had handed over the works I had then in charge to my successor, I started on my journey to British Columbia; at Toronto I met Messrs. Gamsby, Bristow, Michaud and Carman, who were engaged to go with me, to be employed on the surveys. We proceeded by railway to San Francisco, thence by steamer to Victoria, British Columbia, where we arrived on the 26th May.

On my arrival there, I found the position of the parties who had been engaged on the surveys since the previous year to be as follows, viz:—

Two parties of surveyors, Q and R, under Mr. R. McLennan, had wintered in camp, the former on Canoe river, near Albreda lake, and the latter on the Fraser river, about fifty miles below Tête Jaune Cache. Mr. McLennan, who had during the winter visited Ottawa for the purpose of reporting to you what had been done the previous year, had left Victoria [illegible] miles.

[illegible] a series of con- [illegible] a few hundred feet [illegible] the mountain slopes [illegible] for a line of railway is therefore confined within very narrow limits and is only a question of detail to be worked out by the surveying parties. It was, therefore, unnecessary for me to visit this District till late in the season when the surveying parties would have their field plans and profiles ready—showing the results of their surveys and the difficult points requiring examination.

This left me the early portion of the season to devote to that District which you placed under my special charge, viz: between Victoria (Vancouver Island,) Bute inlet and the Fraser River, and thence, with the two parties under Mr. McLennan, to complete the junction with the line from Kamloops through the Yellow Head Pass.

I therefore commenced immediately to arrange parties for this District and succeeded with the four gentlemen who accompanied me from Toronto, and others whom I found at Victoria, in forming three surveying parties—one to survey the islands and channels between Vancouver Island and the main land opposite the entrance to Bute inlet, and the other two to continue the surveys up the N. W. shore of Bute Inlet and through the Cascade Mountains by the Homathco pass, and thence across the Chilcotin plains to the Fraser river.

Leaving the officers in charge of these parties to engage their chainmen, axemen, &c., and get ready their stores and camp equipage, I went over to New Westminster on the invitation of His Honor the Lieutenant Governor, to examine the country about one of the proposed termini for the railway.

I remained there several days; great numbers of Indians came down the Fraser river, from the Strait of Georgia and the numerous inlets which pierce the mainland, to take part in the games and festivities in celebration of Her Majesty's birthday.

His Honor the Lieut. Governor introduced me to such of the tribes as we were likely to come in contact with in making the surveys, explaining to them the object of our work, and enjoining them not to molest us in any way, but to assist us and work for us, for which they would be well paid.

We then engaged some of them to be on the lookout for us when we should pass up the straits in a steamer in about a week hence.

When I returned to Victoria, I found the parties all prepared for work. Some instruments, however, were required for which we should have to await the arrival of the next steamer from San Francisco.

In the meantime rumors had come down from the mainland of a misunderstanding between some squatters in the Chilcotin country and the Indians, and that the former had left the country with their cattle and burnt up what they could not take with them.

As these are of the same tribes of Indians by whom the late Mr. Waddington's trail party were murdered in 1864 in the Homathco pass, which we were now going to survey, it was thought necessary that we should go armed, and also that a gun-boat should be sent with us up to the head of Bute Inlet, to show the Indians that we were there by the authority of the Government and would be protected, and to create an impression that we knew would soon be communicated far and near—the Indians having a wholesome dread of the big guns. This caused some delay, as the Dominion Government had to be communicated with.

JOURNEY TO BUTE INLET AND COMMENCEMENT OF THE SURVEY.

On the 14th June all was ready. The stores, baggage and camp equipage were put on board H. M. Gunboat "Boxer," Captain Fitzgerald in command, and the Surveying Parties proceeded to Esquimault and embarked on H. M. S. S. "Scout," Captain Cator, the senior officer of the station, in command.

On Saturday, 15th June, at 3 a. m., we steamed out of Esquimault Harbour, the "Boxer," making for Nanaimo for coal; the "Scout," with the surveying party and myself on board for Burrard's inlet, where we arrived at noon, and took on board His Honor the Lieutenant-Governor, and A. T. Bushby, Esq., County Court Judge. We then steamed up the Strait of Georgia and before sunset entered Pender harbour, on the Seechelt peninsula, and anchored for the night.

Sunday morning, 16th June, His Honor the Lieut.-Governor, Captain Cator and myself, visited an Indian ranche, then returned on board to Church, after which we steamed out of the Harbour and up Malaspina Strait, against a stiff head wind. Passing opposite an Indian Village we saw a flag flying, and sent a boat ashore. Here we found the Clahoose Indians whom I had engaged at New Westminister, but the sea was too rough for canoes, and the boat returned with only one Indian on board, who could speak a little English. We took him along with us as interpreter, and to make arrangements for the rest of his tribe to follow.

Owing to the strong head wind we failed to reach the rendezvous with the "Boxer," at Carrington Bay, Cortes island, and had to put into Gorge harbour, farther to the south on the same island, and anchor for the night. We started early next morning (17th June) and met the "Boxer" steaming out of Carrington Bay; we then went in company up the Sutil and calm channels to Stewart island, at the entrance to Bute inlet; here the "Boxer" anchored, and we landed the Y Party, under Mr. Michaud, for the survey of the channels and islands. The "Scout" then went back to Malaspina Strait to bring on the Indians and canoes, which we required to take us up the Homathco river. While the stores and camp equipage of the Y Party were being landed, I took a boat with Mr. Michaud, examined the channels between the mainland and Valdes island, and gave instructions respecting the survey. After seeing the party encamped, the "Boxer" steamed up Bute inlet, and arrived at Waddington harbour about sunset. The "Scout" arrived about midnight.

Though having but little connection with the object of the surveys, I cannot refrain remarking the extraordinary intricacy and surpassing beauty of the Archipelago of the strait of Georgia. Islands of infinite variety of size and form with deep gloomy forest clad glens and sunny glades, low moss covered rocks rising softly from the waters edge, and domes towering up one to three thousand feet in height. Bold headlands and cozy bays, deep and narrow channels leading into romantic and snug harbours: while, steaming along and looking northward to the mainland the dark outlines of one or more of those numerous fiords or deep water arms of the sea, which form the most striking feature of the coast of British Columbia, can be traced far inland till lost in the distance among mountains capped with eternal snow.

Bute Inlet is one of those arms, about 45 miles long and between two to three miles wide, its direction is nearly due north, and it pierces directly into the Cascade or Coast chain, between walls of granite rocks, bold and rugged in outline, rising into domes 3,000 to 4,000 feet in height and solitary snow capped peaks, 5,000 to 9,000 feet high, connected by broken sierras, altogether forming a scene of gloomy grandeur probably not to be met with in any other part of the world.

The slopes of these mountains descend directly into the sea more or less abruptly, the bases of the lower ranges recede and form bays from which rise easy slopes covered with dense forests, those of the higher domes and peaked mountains project far into the inlet forming bold headlands rugged and steep, often terminating in rocky cliffs descending almost perpendicularly into the water, so that the ribs of a vessel might touch the rocks and her keel be in deep water. The first view of these might well cause one to despair of getting a railway constructed, but a careful study of the plans will shew that this can be achieved and possibly at a cost that will render this line praticable.

June 18th. The "Scout" had brought forty Indians of the Clahoose tribe and a number of canoes made out of solid cedar logs; these canoes are from 25 to 30 feet in length and from four to six feet beam and carry 2,000 lbs. to 5,000 lbs. of freight. With these and the assistance of the ships men, the stores and camp equipage were landed and taken two miles up the Homathco river to the Waddington town site and placed in a building erected by the late Mr. Waddington. Close by was an Indian rancherie, then vacant, which was immediately taken possession of by our Indians. All the baggage was got up by noon next day and the tents pitched, then, with the assistance of His Honor the Lieutenant Governor and Mr. Bushby, six canoes were engaged, each with a crew of six Indians and four more Indians to assist the surveying parties on shore. His Honor the Lieutenant Governor and party then took leave and went on board the "Scout" and we commenced to load the canoes for a start next morning.

In ordinary cases it would be sufficient to report only the results of the surveys; but in this mountainous country, so little known, without roads, in great part covered with a dense growth of timber and underbrush or inaccessible rocks, the difficulties are so great, not only in prosecuting the surveys, but more especially in getting forward the supplies, that a brief narrative of our proceedings, for at least a few weeks, will best explain those; and taken in conjunction with the high prices of labor and provisions, will in some measure account for the heavy expenditure on the surveys.

The valley of the Homathco where we were now encamped, at the head of Bute inlet, is about a mile and a half in width with little variation for about 20 miles, it then narrows as we ascend the river till at the distance of about 30 miles from the head of the inlet it suddenly closes in and the river rushes through a narrow gorge or canyon between walls of granite rising to several hundred feet in height.

The Waddington Town Site is on the left or east bank of the river on a flat near the head of the inlet, it is covered with spruce, hemlock and cypress (or cedar) trees of large dimensions and a very fine quality of timber. A few miles up, the hemlock and spruce almost disappear from the bottom lands, and cypress trees of enormous size take their place; these measure from five to fifteen feet diameter at the butt, bell shaped for twelve to twenty feet up from the ground, then gently tapering they shoot up straight and clear two to three hundred feet, forming perfect models for unconnected columns, such as a monument or lighthouse.

The Homathco river is a turbid glacier fed stream varying from one to three hundred yards in breadth, frequently divided by numerous islets, it dashes across from side to side of the valley striking against the granite cliffs which hem it in; these cliffs rise in places 300 to 500 feet in perpendicular height and in steps from 2,000 to 5,000 feet; over these, streams tumble in cascades like ribbons of silver till broken into spray in their descent. From the foot of these cliffs, where not washed by the river, the slopes are covered with huge fragments of rock, some moss covered, others wiih the fracture quite clean as if recently detached.

Thursday, June 20th—We broke up camp and commenced our march up the valley, the Indians taking all the stores, baggage and camp equipage in their canoes, and the two surveying parties W and X following and clearing out the Waddington trail, which we found difficult to trace, the low grounds being covered with a dense growth of under brush and Aralea, a creeper reaching thee to six feet high with a broad leaf resembling that of a rhubarb plant and a tough crooked stem covered with spines, dangerous to touch as they enter and inflame the flesh causing it to fester and leaving wounds difficult to heal.

The trail was also frequently blocked with fallen trees of gigantic size that would have taken days to clear, and often a new trail had to be cut round them; nearly all the log bridges across swamps and streams had been burned by the Indians to prevent pursuit after the massacre of Mr. Waddington's trail party in 1864. These we repaired sufficiently for the passage of pack animals. At the end of the first day we had only gone five miles, where we had to wait for the canoes, as by the windings of the river they had a longer distance to go.

The river was very full and rapidly rising, and to avoid the strong currents the canoes had to be kept close to the banks, which were strewed with fallen and drift timber; this had to be cut away, and in many places the canoes had to be hauled up with a tow line; they had also frequently to cross the river, and lost a considerable distance at each crossing, as they were carried down by the force of the current.

On Saturday evening, after three days of excessively hard labor, we had only made eighteen miles and repaired the trail sufficiently to carry pack animals for about nine miles. Beyond that there were so many bridges gone and so much brushwood and fallen timber across the trail that to keep up with the canoes, the land party for the present, had to be content with opening up the trail sufficiently for themselves to pass, cutting steps in the huge trunks of the fallen trees by which they could climb over.

And now we were at a bend of the river which for several hundred feet washed the base of a perpendicular cliff of granite, three to four hundred feet high; the bridge made by Mr. Waddington round the face of this had been washed away and it could not be rebuilt in the present state of the river, so that I had, reluctantly, to abandon my intention of repairing the trail for pack animals, and depend altogether upon getting our supplies up by canoe, which caused much anxiety, as the river was rapidly rising, and some of the Indians were already discontented and wanted to go back.

We remained at this camp over Sunday, and on Monday morning (24th June) started again, but at two miles from camp the river became very rapid, the Indians declared they could not take the canoes any farther, and they put into a creek, which the trail crossed by a bridge; here we unloaded the canoes and made a temporary depot, calling it the canoe landing.

The surveying parties went on ahead, and the Indians commenced packing* the stores, &c., on their backs; soon after noon on Tuesday the advance party reached the ferry, 28 miles from the Waddington depot.

Three of the Indians had towed up a canoe with some provisions and cooking utensils; this canoe I purchased for the ferry, and put it in charge of two Indians. I then sent back all hands to pack stores from the canoe landing, ten miles below, except a small party with which I went across the ferry, opened the trail, and bridged the streams up to the great canyon, two miles above, returning to camp at the ferry the same evening.

On the 27th June, just one week after we left the Waddington depot, both parties (W and X) were encamped at the foot of the canyon, 32 miles up the Homathco river. I paid the Indians for their trip and sent them back to Waddington depot for another cargo.

I then made up a party to commence the surveys and sent the others to pack the remainder of the stores from the canoe landing and ferry to our present camp.

We traced the line of Mr. Waddington's first attempt at making a trail through the great canyon by the side of the river to the point where it was stopped by a perpendicular wall of granite, we then ascended the cliffs by a circuitous line to explore a route by which we could find footing to make the survey through the canyon.

From these heights the scene presented was singularly wild and sublime; from our feet, over cliffs 400 feet in height, fell in sheets of silver, a beautiful cascade, at the foot of which our camp was pitched on a flat moss covered rock. A hundred feet beneath the camp the Homathco river, then at high flood, rushed out of the canyon with deafening roar—in every direction were grey walls of rock, thousands of feet high, serrated and broken by dark chasms: above all rose peak after peak clothed in snow of dazzling brilliancy, and connected by curtains of glaciers out of which issued torrents that fell in cascades till lost as they descended into the gloomy chasms by which they found their way to the river. Nor amongst this wildness were there wanting the softer elements of beauty—in every crevice to the base of the snow clad peaks were clumps of evergreen trees, and lower down wherever a handful of soil could rest, it was sprinkled with wild flowers amongst which bloomed the sweet lily of the valley.

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*The carriage of supplies, &c., on the backs of men or mules is designated *packing* on the Pacific slope.

just come down with me, and asked them if they would go up another trip at once, they said no, they wanted to rest half a moon. I told them this would not do as my men wanted provisions; we gave them an hour to decide, at the end of which they returned and said they would not go. I then paid them off, and Mr. O'Reilly ordered them to decamp at once, as we should engage other Indians, and they must not remain there to molest them.

Thursday, 11*th July*, at daybreak, we steamed down the inlet, and at noon anchored off Stewart's island, on which the Z party were encamped, Mr. Michaud in charge. I immediately sent a messenger to a village of Eucletah Indians, a few miles up the strait, asking the chief to bring down a number of his people who had applied to us for work and whom we now wished to engage. I spent the rest of the day with Mr. Michaud examining the channels and the surveys that had been made. Next day we continued our survey from sunrise, and at seven a. m. we met our messenger with the Indian Chief and several canoes full of Indians, and directed them to the gunboat, to which we returned at ten a. m. After breakfast we engaged the chief and twenty of his tribe to go with their canoes to the head of Bute inlet, and thence up the Homathco river with supplies for the surveying parties.

These Eucletahs are a warlike tribe, and, holding the narrow channels about Valdes and Thurlow islands, were formerly a terror to the other Indians and the early settlers on Vancouver Island. They are finely built, strong and active, and they seemed anxious to work for us, those whom we did not engage exhibiting great grief at being left behind.

We started about noon, and on our way up the inlet went ashore and visited two camps of Indians whom we had discharged the day before and recovered some rope, axes, &c., which they had appropriated; on arriving at the head of the inlet we found several of them still occupying the sheds at the depot; but at sight of the blue-jackets—whom they evidently did not expect—they quickly decamped and have not since given us any trouble.

I then wrote letters for the W and X party, telling them what had occurred, and requesting them to furnish Mr. O'Reilly with supplies and give him all the assistance in their power. I also gave Mr. McMillan both verbal and written instructions, and at midnight took leave and went on board the "Boxer," which immediately steamed away down the inlet. Next day, relieved of all immediate care, I felt the re-action, and bruised lacerated and thoroughly exhausted with hard labour and anxiety, I enjoyed the luxury of a thorough day's rest, as we steamed along among the beautiful islands that dot the Strait of Georgia. On Sunday morning, 13th July, we arrived in Esquimault harbour just one month from the day we started from the same place.

JOURNEY TO QUESNELLE MOUTH AND FORT ALEXANDRIA.

I remained a few days in Victoria, and started—19th July—by the first steamboat that made connections with the up-country stages. From Yale I had a good opportunity of inspecting the line by the Fraser and Thompson Rivers, which had been surveyed last year (1871); this appeared so unpromising that I should not have considered it worth an instrumental survey till other routes had been explored.

On the 25th July we passed the Q party's camp by the roadside, a few miles to the west of Lake la Hache, and at 10 a. m. same day arrived at the 150 mile house, here Messrs. R. and J. McLennan were waiting for me; after consultation with the former we immediately sent the latter back to the camp to get ready a pack train to go across the Chilcotin country with supplies for the W Party coming up the Homathco River.

Mr. R. McLennan and myself went on by the stage to Soda creek, and thence by steamboat to Quesnelle mouth, carefully noting the character of the banks of the Fraser on our way up. On Friday and Saturday we explored the country from the mouth of the Quesnelle river, twelve miles up to the head of the first canyon, and found it practicable for a railway—with a favorable place for bridging the Fraser river.

Early on Monday morning, the 29th July, we returned down the Fraser by steamboat, and noted a line on the right bank favorable for a railway down to a stream which enters the Fraser about 25 miles above Alexandria.

We found the pack train waiting opposite Alexandria; got it put across the river by the steamboat, and there Mr. McLennan left me.

JOURNEY TO HOMATHCO PASS AND RETURN BY THE CHILCOTIN AND FRASER RIVERS.

The train consisted of twenty pack animals, together carrying over 5,000 lbs. of supplies, and four saddle animals for the master of the train, (Cargadore) two packers and a cook; three of these were Mexicans and one English. They were with difficulty persuaded to go as rumours were rife of the warlike attitude of the Chilcotin Indians, but when they saw that I was determined to go they reluctantly consented to go with me.

At Alexandria (with the assistance of Mr. McGinly, a retired officer of the Hudson's Bay Company) I engaged two Chilcotin Indians as guides with a horse for each and one for myself—also a Shuswaps Indian as interpreter, who understood the Chilcotin language and a little French—and a Canadian axeman, whom Mr. McLennan had sent me from Soda creek.

We camped that night near Alexandria and next day, Tuesday 30th July, we started at seven a. m., on the old Bella Coola trail which leads by Alexis and Puntzee lakes; at four miles we had risen 1,100 feet above the level of the Fraser, and at six or seven miles crossed a stream 20 feet wide and 900 feet above the same.

This stream is nearly parallel to the Fraser but runs in an opposite direction, then turning at right angles falls into the Fraser about twenty-five or thirty miles above Alexandria, the valley affording a practicable line for a railway from Quesnelle mouth southwesterly on the Chilcotin plains.

About three miles farther on we recrossed this stream at the forks, where a smaller stream enters from the south west, the larger one bearing small stream flowing into one of the lakes we camped (No. 6), and remained there over Sunday—warm weather with thunder showers.

The chief Alexis looks fully fifty years of age, rather under the middle height, has small black restless eyes, expressive of distrust—he was evidently frightened as he knew that a large party was coming up the Homathco river and another crossing the Fraser at William's lake, both parties armed and converging on the Indian camps at Alexis and Puntzee lakes.

I pointed out to him that my party was not armed except with one rifle for killing game, and tried to explain to him the object of our work, assuring him that we should not injure, in any way, him or his people. Gradually he seemed to comprehend this, and then chatted pleasantly—if that were possible through an interpreter.

Monday, 5th August—At sunrise the weather was cold, almost freezing—we left camp at seven a.m., and two hours after passed by a defile over the end or spur of the range of hills that had appeared on our right for several days and which we had been gradually approaching. The aneroid gave the summit of the Pass 4,000 feet above sea level and the crest of the range would be 200 to 500 feet above that,—we then descended gradually into the valley of the Chilcotin and reached the river about two p.m., and camped (No. 7) about seventy-five miles from Alexandria.. Altitude of river, about 2,900 feet above sea level.

Tuesday; *6th August.*—Forded the Chilcotin river—about forty yards wide—and ascended the plateau on its right bank, which is about 300 feet higher than the river where we crossed; about three miles from camp we struck the Puntee lake, and followed up its north bank near to its head—we then passed over a spur and in less than a mile came upon Puntzee lake; there is but a narrow neck of land between the lakes, and both drain into the Chilcotin river. Here the character of the country changes considerably. Between Alexandria and the Chilcotin river it is a rolling plateau, the elevated portions covered with a shallow parched soil, supporting a forest of stunted black firs from three to twelve inches diameter, and rarely exceeding fifteen inches; and scarcely any grass. The depressions are filled with lakes, ponds, swamps and marsh meadows, often in long continued chains; the slopes of the valleys sustain an inferior growth of bunch grass with wild vetches.

After passing to the south of the Chilcotin river the country assumes more of the character of a rolling prairie; low ranges of hills, dotted with clumps of trees, giving them a park-like appearance, enclose open valleys covered with bunch grass and adorned with beautiful lakes; but still the country is better adapted for grazing than for agriculture; the soil is generally dry and sandy, requiring irrigation, and the elevation of the valleys being about 3,000 feet above sea level, they are subject to summer frosts.

On leaving the Puntzee lake the pack train went by the trail over a high hill, but I followed up the north side of the lake and the valley at the head of it and over the low neck of land which divides it from the Chilanco valley. Puntzee lake is about six miles long with a very irregular and picturesque outline. Following up to the Chilanco valley I struck the trail at five p. m., and found the party encamped (No. 8) near the Chilanco river about 94 miles from Alexandria.

Wedneday, 7th August—Crossed the Chilanco river—about 40 feet wide—and at nine p. m. reached the foot or east end of Tatla lake, about 100 miles from Alexandria ; the trail following the north west bank of the lake through a charming valley bounded with rolling park-like hills.

At eleven a. m, we met Mr. O'Reilly's party, with Mr. Teideman and two axemen from the surveying party W ; they had been eight days coming from the camp of that party, and gave deplorable accounts of the difficulties they had encountered, climbing high mountains, crossing glacial torrents or forcing their way through almost inpenetrable cedar swamps We found afterwards that they had been misled by their Indian guide.

Here I learned from Mr. O'Reilly that the Eucletah Indians, whom I had engaged before I left Bute inlet, had gone up the Homathco river with supplies as far as the ferry, but there the two Indians whom we had left in charge told them that a band of Chilcotin Indians—(with whom the Eucletahs have a feud)—were coming down the valley, upon which they threw down their loads, ran to their canoes and made for their homes with all possible speed ; thus the W party were cut off from their supplies from the coast, and Mr. Teideman was on his way to Soda creek to endeavour to get supplies sent from there; but I had anticipated the difficulty, otherwise the party must have been broken up, for all their provisions would have been consumed long before Tiedeman could have relieved them. I supplied Mr. O'Reilly with provisions for the rest o his journey to Alexandria; the chief Alexis went back with him and Teideman and his two axemen returned with me; in the evening we camped (No. 9) by the margin of Tatla lake not far from the camp of Keogh the chief of a small band of Indians who subsist by fishing on the lakes and hunting on the slopes of the Cascade mountains, from which they have the local name of "Stone Indians,"—they had a number of horses pastured round the camp.

Thursday, 8th August. Soon after ten a.m. we reached the head o Tatla lake, which we estimated to be about twenty miles long and no over a mile in its widest part. In the evening we reached the watershed between the country drained by the Chilcotin into the Fraser river, and that by the Homathco river into the Bute inlet, and camped by a small stream near an Indian burying ground.

Friday, 9th August. We had now entered into the Homathco pas through the Cascade chain ; travelling for some miles on a high tongue o parched land covered with stunted firs with a chain of lakes on both side of us, till we came to a deep swamp—through which flows a sluggish stream or canal, connecting the two chains of lakes into one at Bluff lake here we had to unload the animals and pack their loads by hand over the swamp ; a mile and a half further on we came to a steep bluff about 600 feet high, over which we attempted to get the pack train, but failed, so we had again to unload the animals, and with the assistance of a few Indians camped near, we carried the loads to the lake and rafted them round the bluff. This detained the pack train a whole day, but I went on with small advance party, and at noon on Sunday, 12th August, reached the head of Middle Lake—estimated about 144 miles from Alexandria—and camped. No. 12.

There was no trail for animals beyond this, so I sent an Indian and one of the axemen with written instructions to Mr. McMillan, then in charge of party W, whose camp was estimated to be forty miles distant, or five days' journey with a pack.

Monday, 12th August.—About noon the pack-train arrived, and we made a depot for the supplies. Mr. Teideman and the one axeman he had with him commenced to make a raft to take the supplies down the lake. The position of the party below was critical; the three Indians whom I had brought with me from Alexandria would go no farther and started on their return home. Most of the Indians of the neighborhood were away hunting or fishing, and it was questionable if the few that were left could be engaged for the hard work of packing over a rough and rocky country, so that possibly the whole of the surveying party would be forced to leave their work and come up for provisions, which would seriously retard their progress. I explained all this in my instructions to Mr. McMillan, assuring him I would do all that possibly could be done to relieve them, and informing him that Mr. O'Reilly had promised to use his utmost endeavors to engage Indian packers to come to their assistance.

Fortunately he was successful, and a party of Indians reached McMillan's camp with supplies before any inconvenience had been suffered.

Tuesday, 13th August.—I took leave of Mr. Teideman and started on the return journey taking levels with the aneroid, and tracing a line for the railway as I went along, and making rough topographical sketches for the use of the surveying parties. Travelling light we advanced rapidly and before noon of the third day we passed the foot of Tatla lake Leaving the Puntzee trail we followed the Chilanco valley, and camped within nine miles of the confluence of the Chilanco and Chilcotin rivers. We were glad to have left the elevated plains and again to hear the murmer of running water, for beautiful as are the lakes, the silence of the plains, only broken by the stealthy tread of the Indian or the sad wail of the solitary loon, was oppressive, and we felt our isolation from the world more complete than in the deep gloom of the canyon, where the awful grandeur of the mountains, the roar of the waters and constant sense of danger keep the nerves strung and the mind active. At midnight an Indian messenger came from Mr. R. McLennan, who was about twenty miles' farther down the river; he had come to meet me, but got short of provisions, and not knowing that I was so near had turned back.

Friday, 16th August. We crossed the Chilcotin river about noon near its confluence with the Chilanco, and at two p. m. met Mr. Johnson with thirteen Shuswap Indians (from the Fraser river near Lilooet) whom Mr. O'Reilly had engaged for me at Soda creek.

I supplied them with provisions, of which they were short, and directed them to our depot at Middle lake, where, as I subsequently learned, they arrived in good time, and each took on his back a load of 120 lbs. of provisions down to the W party, arriving when the party had only three days provisions left. These Indians turned out to be excellent workers, and remained with the party the rest of the season. In the evening we camped near the junction of the Chilco and Chilcotin rivers.

The Chilanco and Chilcotin are charming valleys, varying from a few hundred yards to over a mile in breadth, in which groves of trees and open prairie alternate. The bottom lands covered with a rich growth of bunch grass which, now ripe and mellow, looked like fields of waving corn, through which meandered in graceful curves, fringed with willow, alder and poplar, the dark clear streams from the lakes on the elevated plains. The pale greyish green of the lighter growth of bunch grass and artemesia that carpeted the upper benches and rounded hills which bound the valleys was in agreeable harmony with the dark foliage of the spruce and fir trees growing singly or in clumps in picturesque irregularity,—altogether forming a scene of pristine beauty rarely to be met with.

The soil of a great portion of the bottom lands is rich and well suited for agriculture, but would require irrigation, which in a great measure could be obtained at moderate expense by the erection of weirs across the rivers which, above the mouth of the Chilco, are not subject to heavy floods.

The Chilco is a turbulent glacial stream coming down from the Cascade mountains, much larger in volume than the Chilcotin above their confluence; their united currents make a formidable river eighty to a hundred yards wide and very rapid.

Saturday, 17*th August*. The country from the Homathco pass to this point (mouth of Chilco) is remarkably favorable for a railway, but an hour after starting to-day we crossed the edge of a basaltic ridge close to the river which would require a short tunnel. After this a beautiful plain for several miles; then high bluffs of clay and rock begin to close in on the river, which would necessitate some heavy excavations.

In the evening we camped high up on the slope, by a small stream near a cultivated patch of ground, and remained there over Sunday.

Monday, 19*th August*. I picketed a line for about three miles through a rough broken country, marking the levels, taken by the aneroid, on the trees and pickets; just below the camp the line ran through a basaltic dyke, about one hundred and fifty feet across; and half a mile further down a range of limestone a third to half a mile in breadth crosses the valley, the river flowing through the range in a narrow crooked canyon; below this the valley, though broken, is comparatively easy for about seven miles, where we camped. (No. 16.)

On our journey of the last two days, I noticed that the river was descending at a much greater inclination than the valley, and, consequently, the banks increasing in height; but from this point downwards the valley rises from each side of the river in two or three steps or benches of alluvial formation, sharply defined, and certainly indicating the level of the water at different epochs. Our present camp is on the lower bench by the river, and by the aneroid the height is 2230 feet above the level of the sea, and that of the upper bench is 2480 feet. I found subsequently that this height is maintained not only on the Chilcotin river, but on the Fraser, Clearwater and Thompson rivers, at points two hundred miles apart; the height of the upper benches, by the aneroid, varying from 2400 to 2500 feet above the level of the sea.

Tuesday, 20*th August*. For the first twelve miles of this day's journey, the valley was rather rough, and broken with a number of land slips, some of them well grown over with shrubs and grass, others of more recent date, and looking very insecure for constructing a railway on; then we came to a rocky bluff, the base of which is washed by the river for half a mile or more. We could not pass this, so we had to go back and find a way to the summit of the hill, about 1400 feet above the level of the river, descending on the other side into a deep ravine with slopes so steep that it would not have been possible to take loaded animals down.

The valley got still rougher as we advanced; serrated with a close succession of lateral ravines which commence in the hills that bound the valley and get wider and deeper as they cut through the successive benches towards the river; many of these, even on the upper bench, eleven hundred feet above the level of the river, are one to two hundred feet in breath and the same in depth.

In places where the valley is contracted by a swell of the hills, the whole of the benches have been carried away by the river, leaving a continuous slope of loose stones, gravel and clay from the brow of the hill to the river.

In other places parts of the clay benches are left standing in huge shapeless masses, turreted and broken, presenting the chaotic appearance of a country that has recently been swept and torn by a great flood. In the evening we descended with difficulty from the upper bench on which we had been travelling, by a steep slope to the edge of the river and camped (No. 17) about four miles from the Fraser river.

Wednesday, 21*st August*.—We left the Chilcotin river and ascended the hill which bounds the valley on the east side, from which we had a bird's eye view of the Chilcotin valley down to its junction with the Fraser, and which appeared even rougher than that which we had traversed yesterday; we followed an Indian trail along the brow of the hill till we reached a cross valley that cuts off the acute angle between the two rivers above their confluence; this cross valley is considerably higher at the end next the Chilcotin than the upper benches of the latter, but as it shortens the distance considerably and cuts off some very rough ground in both the Chilcotin and Fraser valleys near their junction, I directed the survey to be made by this route. We followed up the Fraser valley two or three miles, then we had to make a long detour to the north to head out a deep ravine; passing this we ascended the high level of the rolling plateau and saw spread out before us, as far as the eye could reach, an undulating grassy plain dotted with trees, the water courses and lakes being distinguishable by belts or groves of fir and poplar, and close to us was a deep but open valley which we could trace far away, to the north till lost in the undulations of the plateau.

In the bottom of this, right in our course, lay a cultivated farm, to which we descended—1,400 ft.—by very steep slopes, and there met the owner L. W. Riskie, Esq., a Polish gentleman, by whom we were hospitably entertained and from whom I received much useful information about the country. This valley looked so favorable that I wrote to Mr. R. McLennan directing him to make the first trial survey by that route and endeavour to get from the head of the valley by some depression in the plateau into the Chilcotin valley.

We camped (No. 18) by a cross stream in the Fraser valley, about six miles from Riskie's.

Thursday, 22nd August.—Mr. Riskie had informed me that the Q party had crossed to the west side of the Fraser some two weeks before, and were now nearly opposite Chimney creek. I sent the pack-train there by the lower trail, and taking with me one man we rode by the regular trail to a point opposite Soda creek, where, after some delay, there being no regular ferry, a boat was sent across for us.

JOURNEY TO CARIBOO.

Friday, 23rd August.—I sent my man back to the Q camp with the horses; wrote instructions to Mr. R. McLennan, who was at the 150 mile house, respecting the surveys; then hired a waggon and pair of horses to see as much as I could of the country between Soda creek and Cariboo, while a pack-train was being got ready for my journey eastwards. It had een suggested to me that the gap through which the Fraser river crosses the basaltic belt below Alexandria might be found narrow enough to span with a suspension bridge, by which the difficulties and cost of crossing the Fraser valley would be greatly diminished. I, therefore, on my way up, scanned the valley closely, and estimated by the eye that at the narrowest part the cliffs on each side of the river are fully one mile apart.

At Alexandria the valley opens out by successive benches to a much greater breadth than at any other portion below Quesnelle mouth, and there are lateral valleys or depressions on each side by which the high table land could be reached with grades sufficiently easy for a good waggon road, but too steep to be worked by locomotives of an ordinary railway train. Above Alexandria there are heavy land slips on the left bank of the Fraser; but the right bank, of which I now had a good view, looked much more favorable for a railway line. I therefore directed Mr. R. McLennan to make a flying survey of the Narcosslee valley from the point where I crossed it on the trail from Alexandria to its junction with the Fraser, twenty-five or thirty miles farther north.

At Quesnelle mouth we enter the Cariboo range, which is a sea of mountains covered for the greater part with a dense growth of spruce and fir, and intersected with numerous narrow deep winding valleys. There has evidently been great geological disturbance; the strata is broken and tilted up on edge at various angles, and in digging for gold old channels have been found deviating considerably from the present lines of the water courses.

There is a good road from Quesnelle mouth to Barkerville—about 60 miles—and possibly a practicable line for a railway might be found up one or more of the valleys to a point near the head of the north arm of the Quesnelle lake, but eastward from that to Tête Jaune Cache no indication of a practicable route has yet been found.

I visited several of the gold mines; the largest works are those of Messrs. Kurtz & Lane, about two miles below Camerontown; the valley there widens out to an extensive meadow which they are attempting to drain, but hitherto without success; they are, however, sending up more powerful machinery, and great hopes are entertained that they will ultimately be successful.

I returned to Soda creek on the 2nd of September, where Mr. McLennan arrived a few hours after me and reported his survey of the Narcosslee valley, which was satisfactory and left no doubt of a practicable line from Quesnelle mouth to Bute inlet.

Next day we went on by stage to the 150 mile house, where I completed my topographical sketches of the line to be surveyed between the Homathco pass and Fraser river, which I gave to Mr. McLennan to assist him in directing the surveys.

Journey from the 150 Mile House to the North Branch of the Thompson River.

Friday, 6th September. At 9 a.m. I started on this journey, taking with me one Canadian axeman, two Indians, and a train of seven animals, including saddle horses.

We followed the well beaten trail leading to the forks of Quesnelle, about eight miles, then took an Indian trail running in a more easterly direction. On the second day, at noon, we entered Beaver lake valley, which we followed up for an hour; then struck across a neck of high land to a Chinese mining camp, on the Horsefly river, about fourteen miles above its junction with Quesnelle lake. Near this we pitched our tent, and remained over Sunday.

The country traversed these last two days is an elevated rolling plain, the highest swells being about 4000 feet above the level of the sea. It is much cut up with narrow crooked valleys, in which there are numerous small lakes; the bottom lands afford a rich pasture of meadow grass and vetches.

The Beaver lake is the most important of these valleys. In some places it is fully a mile in breadth and contains some good agricultural lands, and abundance of meadow grass; on the slopes are some patches of inferior bunch grass, but we are here on the northern verge of the bunch grass belt. This valley joins that of the Quesnelle between thirty and forty miles above the mouth of the latter, and in connection with the Horsefly valley, affords a good line for a railway between the Clearwater and Fraser rivers.

Accompanied by our Indian guide, I rode down to Quesnelle lake and took the level of it with the aneroid; we followed Captain Mitchell's trail by the Horsefly river, which has not been used for several years, and for many miles it was so much obstructed by fallen timber that we had great difficulty in forcing a way through.

Monday, 9th September.—Started at eight a. m. up the Horsefly valley, which we followed for an hour to a point from which our Indian guide had agreed to take us by an Indian trail direct to Canim lake, but now he acknowledged that it was so long since he had been there he had forgotten the way, and he said the country was so full of swamps and broken ground that it was hardly possible for us to get through. We had, therefore, to strike for the Mitchell trail, which we found on the margin of a deep crooked valley tending generally in a southerly direction.

From several high points on the trail I had a fine view of the Horsefly country: it is a broad plain lying between the trap ridge that bounds the south side of Quesnelle lake, and similar ridges on the north of Canim and Mahoud lakes, and it is broken by spurs from these ridges running north and south; the plain rises towards the east till it joins the high hills that bound the west side of Clearwater valley. The Horsefly river runs in a narrow valley, which, at the point we left it, is about 100 feet below the level of the plain, and 3,000 feet above sea level.

We had great difficulty in following the trail on account of fallen timber, which forced us to make long detours that often led us into impassable swamps; then again many of the bridges and corduroy roads were rotton, and could not carry the pack animals; after passing a number of lakes, ponds and marshes, we found on the second day that we had passed the dividing ridge and the streams were now flowing southward; in the evening we camped in an open valley with plenty of good meadow grass in the bottom, and here left one of our horses which had broken down and could go no farther.

Wednesday, 11th September.—Started at 8 a.m down an open valley, and in two hours struck the waggon road at the 111 mile house. Here I discharged the Indian guide, laid in some fresh provisions and then started eastwards, following the waggon road three miles, we then took a well beaten trail which in four hours led us into the valley of Bridge creek, and we camped on the banks of that stream.

Thursday, 12th September.—We followed the same trail to the point where it crosses over to the South side of the valley and thence over the hills to the Clearwater,—but as Mr. R. McLennan had informed me that the R party were coming up to the North side, we followed an Indian trail on that side; the valley here is fully half a mile wide and yields good meadow grass, and on portions of it, partly covered with alder and poplar, there is good soil for agriculture. About noon we came upon a party of haymakers, but they had not seen or heard anything of the surveying party, and knew nothing of the country beyond the head of Canim lake, five miles distant. On arriving there we found that the trail stopped short at the lake as the Indians from this point travel by canoes on the lake; this was perplexing, but as I fully expected the surveying party was at no great distance I decided to go on, and we proceeded slowly, picking our way amongst fragments of rock and fallen timber, sometimes following a deer trail that would lead us several hundred feet up the mountain to avoid rocky spurs that jutted into the lake; towards evening we made for a grove of poplars on a low tongue of land shooting into the lake expecting to find grass for the animals—but on arriving found only some rushes for them—here we camped (No. 6.)

Friday, 13th September.—Our difficulties from fallen timber and deep cross gulches increased so much that we were forced to try the beach, but found it impossible to travel on the large boulders; however, as the lake was now several feet below high water level, we found good footing in one to three feet of water on the gravel benches formed from the disintegration of the neighbouring rocks In this way we went for miles, frequently having to swim the animals round rocky bluffs projecting into deep water. About noon we came to a large stream which we crossed on a sand bar at its junction with the lake. On the margin of this was plenty of marsh grass; here we stayed two hours to feed the animals; we then proceeded, most of our way in water, and about noon next day reached the foot of the lake. Here we found the whole valley covered with rich grass and wild vetches, and remained two days to recruit the animals.

Though the difficulties of travelling these last two days without a trail were very great, the shore of the lake, alternately gravel or clay benches 50 to 100 feet high and long stony slopes running right into the water with a few short bluffs, presents no very great engineering difficulties for the construction of a railway, as the profiles subsequently made will shew.

Monday, 16 *September*.—Started early, without any trail, through a heavy growth of cottonwood of large size, much of it fallen. Struggling through this and over some very rough ground beyond, in three hours we were opposite the head of Mahoud lake, but could find no trace of the surveying party. The ground was so rough, and in places swampy, that we had to keep well up the slopes of the hills that bound the valley. At 1 p.m. we came to a mountain stream 90 feet wide, with a rocky bed, but the water was now low and we crossed with little difficulty.

Beyond this the ground became so broken that we had to descend to the lake, and try the shingle, but we found it very bad travelling, and had frequently to swim the animals round cliffs projecting into deep water, or leave the lake and ascend several hundred feet to get a foothold for them; then we would get into swamps, gulches, or a labyrinth of fallen timber, from which it would take us hours to extricate ourselves. I had too few men with me, having expected to meet the R party before we got so far. Towards evening, in crossing a high spur, a prospect lay before us that was appalling.—Instead of being at the foot of the lake as we expected, it spread out before us ten or twelve miles in length, and two to four in breadth, shewing by its dark blue, great depth of water close up to its shores. The south shore, though bold, looked tolerably uniform, but on the north side where we were, the slopes of a high rocky mountain came sheer down to the waters' edge, at places terminating in cliffs several hundred feet in height. Between us and this mountain lay a tongue of low land covered with cottonwood—here we found some rushes that afforded a scant feed for the animals, and we pitched our tents on the beach.

While at dinner we saw fires near the foot of the lake, but on the opposite side to us, which, from their number and size, we knew were not those of Indians, and thinking that they might be the camp fires of the surveying party (R) we made a large fire on a prominent point to attract their attention.

Tuesday, 17*th September*.—This morning by the aid of the telescope we plainly saw the tents of the R party, and three dark objects on the water, which we thought were canoes coming to us, but after waiting an hour, we perceived that these did not move and that they were only floating trees, so at 9.30 a.m. we started, with but a faint hope of reaching the foot of the lake, except with the aid of a raft, which I had not sufficient force with me to make large enough or in time to save the horses and mules. We travelled in shoal water till we came to a loose rock slide extending fully half a mile along the shore and running into deep water; the fragments of rock were of all sizes, from one to several hundred cubic yards each; across this it was impossible to take the animals. I knew from experience that the only chance of a passage was close at the foot of the cliffs, near the crest of the range, from which the rocks had been detached; going some distance back so as to traverse the mountain slope obliquely we commenced the ascent, slowly and painfully, now obstructed by a mass of loose rocks or fallen timber, now an animal weak through want of feed would stumble and roll down the hill till brought up by a rock or tree. At last we reached the foot of the cliff and found a narrow passage, rough but practicable. After passing the rocks, we travelled rapidly for an hour near the crest of the mountain, about 1,200 feet above the level of the lake, till coming to a deep cross ravine we were forced to descend nearly to the lake; and so we went on all day, now ascending, now descending, making detours to avoid rocks, deep ravines or masses of fallen timber.—Towards evening, we reached a torrent that comes down between the mountain on which we had been travelling all day and the lower range or plateau that runs at right angles to it, and forms the watershed between the lower end of Mahoud lake and Clearwater river. Passing this stream with some difficulty, we knew we were safe at last. Two hours more brought us to the outlet of the lake, a river of thirty to forty yards wide, flowing through the plateau in a deep narrow gorge or canyon. I scrambled down a slope of loose rocks to the lake and, at some distance back, found a place by which the pack train could descend and shouted to my men, but got no response, and thought they had found some other road. I returned to the outlet of the lake, and, completely exhausted, lay down on the rocks to wait for the train; an Indian had seen me and reported it at the camp, and Mr. Forrest now came to see who it was,—he assisted me in fording the river, and a few minutes more we were in the camp of the long looked for R division. From this the party had seen our fire and tent the previous evening, and had heard our bell during the day, but thought we were probably some miners "prospecting;" until the pack train arrived they would scarcely credit that we had brought animals over such a country.

These last two days were the hardest I have had on the surveys, and we were in constant danger. Once my mule fell with me from the ledge of a cliff into deep water, from which I narrowly escaped drowning; again while climbing a steep mountain side a mass of loose rock and earth began to move, carrying me down within fifty feet of the brink of a precipice 600 feet high.—The whole staff were often exposed to similar dangers.

Wednesday, 18*th September*. We were too much exhausted to go on, so I spent all day in camp examining plans and profiles, with Mr. Mahood the Engineer in charge of this party. I gave him the levels I had taken at various points between the waggon road and this camp, and instructions respecting the surveys; he had very properly decided to go up the south side of Mahoud lake, and the party making the trail were already several miles ahead. All our animals had lost shoes, and were lame and exhausted, so Mr. Mahood furnished me with a fresh train.

Thursday, 19*th September*. We started again, but now, though the country was rough, we had a good trail to go by—made by the R party—and early on the afternoon of the second day we arrived at the junction of the Clearwater and North branch of the Thompson rivers. By shouting we attracted the attention of the depot clerk, who came and ferried us across, and there we camped (No. 13.)

Here I learned that Mr. John Trutch had waited several days for me, but had gone up the river two days ago, as his parties were about to close their surveys and wanted instructions.

The outlet from Mahoud lake is by a narrow deep gorge or canyon, about four miles in length, to the Clearwater river; in the middle of this there is a beautiful waterfall, about 60 feet in height. The Clearwater from this point near to its confluence with the Thompson, flows in a dark dismal valley, hemmed in by walls of trap and basalt 1,500 to 2,000 feet high, and half a mile to one or two miles apart. The detritus from these forms a slope of broken rocks down to the waters' edge, except where lateral ravines come in, then the walls recede, and there are gravel benches near the river, and farther back, flats of swampy ground covered with cedar or small firs, so dense that a wild animal could scarcely force its way through.

Saturday, *September* 21*st*.—Heavy rain during the night and early morning, but at 10 a. m. it began to clear off, and soon after we started up the Thompson, enjoying our ride, on an excellent trail in a fine broad valley well timbered with spruce, hemlock and aspen trees; near Raft river we got some fresh horses, and soon after, the trail followed the slopes of the hills that bound the valley, which are covered with bunch grass and dotted with firs. We now saw on the mountain tops fresh snow, the first of the season. We camped near the end of the 91st mile of the railway survey from Kamloops.

Next day we started at 9 a.m., the trail rather rough, over some high benches and spurs; at noon we crossed Mad river on a substantial bridge built by the surveying parties; beyond this the valley is contracted by the slopes of a mountain of trap rock; this passed, it widens out again, and at 2:30 p.m. we lunched on a small round open prairie; beyond this the slopes are much cut up with lateral ravines. At 6 p.m, just as it was getting dark, we came to a long bridge close by the river, constructed by the surveying parties and leading on to an extensive flat with good pasture; here we encamped. (No. 15.)

Monday, 23*rd September*.—A sharp frosty morning; we started at 9 a.m., and at one p.m. reached the camps of the U and V parties, where I met Mr. John Trutch. Here we camped (No. 16), and during the afternoon I examined the plans and profiles of the U and V parties with Mr. Trutch. The V party, under Mr. Dewdney, had completed their survey to Albreda lake, and were returning to Kamloops; the U party expected to complete their survey next day.

I had hoped to reach the former party before they left Albreda Lake, as I wished to make some explorations for a pass eastwards to the head of Clearwater or Quesnelle lakes; but the difficulties I had met on my way had thrown me a week behind the time I expected to reach that point, and thus I missed the opportunity of having this important matter cleared up, and it was too late in the season to take the party back

Tuesday, 24th September. We started at 8 a. m., and Mr. Trutch having furnished us with fresh horses we went at a good pace; soon after noon we met yourself and party near the head of the canyon, more than a hundred miles south of the point where I intended to meet you, but you arrived sooner than expected, and I was some days behind time; I thus missed the present opportunity of seeing the whole of the District under my charge; but as you had seen Mr. Moberly near the summit of the Yellow Head pass, and Mr. Mohun with party T a little farther south, and given them full instructions, there was no necessity for my going on at present, I therefore turned back with you and we reached Mr. Trutch's camp the same evening.

The U and V parties had now connected their surveys and were preparing to return to Kamloops.

JOURNEY FROM NORTH THOMPSON TO VICTORIA.

(*In company with Mr. Fleming.*)

Next morning we started down the valley, and at noon on the third day's journey we reached the junction of the Clearwater and Thompson rivers, where we left our horses, and at 1 p. m. Friday, 27th Sept., we embarked on a large boat built by the surveying parties for carrying supplies, and now, manned by four good oarsmen, we dropped rapidly down the river and had a good opportunity of seeing the railway line surveyed and the character of the country; next day at 9 p. m. we reached Kamloops, where we were received by Mr. Tait, in charge of ihe Hudson's Bay Company's Post, and sumptuously entertained.

Monday, 30th September. We went by boat down the Thomson river and by the south shore of Kamloops lake, examining the line surveyed for the railway in 1871 to a point beyond the high cliffs, where Mr. Tait had horses waiting for us, by which we reached Savannah's ferry at sunset; I remained there that night, but yourself and party went on the same evening to Cornwall's, where you were met by His Honor the Lieutenant Governor and where I joined you next day. Here you gave instructions to Mr. John Trutch for the U party to survey a line from Kamloops to Nicola Lake; and for Mr. Dewdney to take the V party to the west end of Lake La Hache and wait instructions

On Wednesday, 2nd October, we all started together in an extra stage for Yale, where we arrived on Thursday evening; next day by steamer "Onward" we reached New Westminster, here we received advices from Mr. R. McLennan of the position of the Q and R parties, and therefore telegraphed Mr. Dewdney to commence at the Q party's initial point near the west end of Lake La Hache, and survey a line eastward to meet the R party coming from Clearwater.

Saturday, 5th October.—With the addition of several gentlemen of New Westminister to our party, and by the kind attention of H. Nelson, Esq., M. P., we were conveyed to Burrard's inlet, and taken across in a small steamer to the extensive establishment of Messrs. Moody, Dietz & Nelson, where we were hospitably entertained. We were then taken over the lumber yards and saw-mills, where we saw logs of the noble Douglas Fir, over five feet diameter cut into planks by two circular saws, one placed vertically over the other; all the other arrangements and machinery for manufacturing the lumber looked very complete; and now a steamer handsomely fitted up was in waiting, in which we were taken down the inlet, round English bay, and across the entrance to Howe's Sound; a delightful trip which gave us a good opportunity of inspecting the shores of these beautiful inland waters; meanwhile the steamer "Sir James Douglas," Captain Clarke, had arrived to take us up the strait, and after dinner we went on board.

Sunday, 6th October.—At two a. m. we steamed out of Burrard's inlet, and all day up the strait of Georgia to Bute inlet; about ten miles up the latter we passed the camp of the depot clerk, Mr. Ross, who came out in a canoe and informed us that the X party were camped about ten miles farther up. At nine p. m. we reached the head of the inlet; it was very dark, and Captain Clarke, who had never been here before, had great difficulty in finding the anchorage.

Next day we started at day-break and steamed down, keeping close to the westerly shore, which we inspected carefully; half way down the inlet we found the camp of the X party, Mr. Gamsby in charge; we went ashore and looked over the profiles, then re-embarked and continued down the inlet, then through the Arran rapids and by Dent island through the Cardero, Nodales, and Discovery channels, and Seymour narrows, to Menzie's bay, where we anchored for the night.

In the evening we went ashore to the camp of the Y party, Mr. Michaud in charge, where we examined the plans, and you gave instructions for further surveys; we then returned on board. Next day we started at daybreak and, closely inspecting the coast of Vancouver Island, we arrived in Departure Bay about noon. While the steamer was coaling we walked by trail through the woods, three miles to Nanaimo. Some of the party inspected the coal mines; others strolled about or called on friends, to pass the time till the steamer arrived.

Wednesday, 9th October.—We started early, and arrived in Victoria soon after noon; we then drove to Esquimault and went on board H. M. SS. "Scout" to visit Capt. Cator, the senior officer in command of the North Pacific station, who received us most hospitably. We returned to Victoria at five p.m., and the same evening yourself and party left in the steamer "Sir James Douglas" for Barclay Sound.

JOURNEY TO QUESNELLE LAKE.

Friday, 11th October.—I received your last instructions this morning, on board the steamer "Enterprise" (at the wharf), on which I was setting out for the mainland. On the 16th I arrived at the Blue tent, or 127 mile house, where I met Mr. Dewdney in charge of the V party, to whom I gave instructions relative to the course of the line to be surveyed from the east end of lake La Hache, so as to cross the waggon road near the 101th mile, by which he would get more easily into Bridge creek valley. Next day I reached the 150 mile house, where I met Mr. R. McLennan, who reported the position of the Q and W parties, and we arranged to have a line surveyed up the Chimney creek valley, on the east side of the Fraser river. Two days more were spent in getting ready a pack train, and hiring men to go with me to Quesnelle lake.

Monday, 21*st October*.—I started with three white men, two Indians and a train of seven animals; on the second days journey the trail crossed a large farm in Beaver Lake valley, near which we camped; this valley as far as I could see, each way from the adjoining heights, looked remarkably favorable for a line of railway; and, as I have already stated, there is but a short neck of land between the head of it and Horse fly valley; next day we arrived at the forks of the Quesnelle river; here there is a thriving mining village chiefly inhabited by Chinese, there being only three white men there, viz:—Mr. Oliver Hare, the constable, Mr. Barry, the proprietor of the bridge across the Quesnelle river and Mr. Barker a miner.

We had difficulty in getting boats fit to go up the lake at this late season of the year, but, through the assistance of Mr. Hare, we at last succeeded in getting one four oared flat bottomed boat, and a small skiff; these were lying at the foot of the lake, nine miles up the river. Mr. Hare and Mr. Barker kindly consented to go with us, which was very fortunate, as Mr. Barker had been up to the head of the east arm last summer, and had carefully noted every bay and sheltered place that would serve as a harbor of refuge in case of storms, which prevail on this lake especially at this season of the year.

Thursday, 24*th October*.—We started with our pack train on a very rough trail up the right bank of the south branch of Quesnelle river, and at the end of nine miles came to still water in which the boats were lying; here we camped (No. 4) and I sent one of the Indians back with the pack animals to Beaver lake, to pasture till our return.

The river for the first four miles above the forks is very crooked and runs between high gravel benches or walls of slate rock; above this canyon there is a land slip of clay and soft rock, leaving a face almost perpendicular, and nearly a thousand feet high; above this the benches are low and the slopes at an easy inclination.

Friday, 25*th October*.—We put all our luggage and stores into the large boat, which was manned by three white men and an Indian. Mr. Hare, Mr. Barker and myself, went into the smaller boat, only built for two, so that even when well trimmed, we brought her gunwales in rather close proximity to the water. I was coxswain, but my chief duty was bailing out, for she both leaked and shipped a good deal of water. At noon we reached Mitchell's landing on the north side of the lake, and at 1:30 p. m. we crossed the mouth of the false north arm, and passed between Cariboo island and two small islets; at 2:30 p. m. we reached Nim's point on Lynn peninsula, where we camped (No. 5) 22 miles from the foot of the lake. The line of the south shore of the lake for the first eight miles, is tolerably uniform, and the slopes from the water not very steep; then there are about four miles, in which it is rocky and broken to where the six mile creek enters the lake. From this to Mitchell's landing (south) is a flat beach covered with cottonwood. Mitchell's landing [south] is on a bay formed by a bold headland that shoots northward from the mouth of Horsefly river, nearly cutting the lake in two; opposite this is false north arm, and between it and Nim's point lies Cariboo island.

Saturday, 26*th October*.—It had blown hard during the night, and at daybreak there were still white crests on the waves. At 7:30 we started obliquely across the lake, making for a sheltered bay on the south shore; we shipped a good deal of water, but in an hour we got under the lee of Lipsett island, then passed through a narrow channel between it and the mainland; we then crept along shore against a light head wind, and at 10:30 a.m. came under the lee of a sandspit, where we lunched and waited till the wind calmed down. We then went on till we came to the headland opposite the north arm; the cross seas from both arms strike on this, and we found it impossible to round it against a headwind, therefore camped (No. 6) 42 miles from foot of lake. The south shore of the lake, from where we struck it this morning, is an easy wavy line, and the slopes not very steep. All the hills that bound the lake on the south side are covered with timber from the water's edge to their summits; those on the north are higher with summits of bald rock.

Sunday, 27*th October*.—It had been stormy during the night, but at sunrise had calmed down, and at 7:30 a.m., we pulled out along shore, and in four hours arrived at Slate Island (58 miles) where the axis of the Cariboo slate (gold-bearing) range crosses the lake. We were now near the entrance to the first narrows, where the lake is only from one to two miles wide, very deep and hemmed in by bold cliffs affording no shelter; but it was now very calm, and at one p.m. we started again, hugging the shore, and in three hours arrived at Limestone camp (No. 7)—72 miles—where the lake bends due north (magnetic). The first 16 miles of this day's journey, the shore line of the lake runs in easy curves, and though the mountain slopes come down to the water's edge, their inclination is not great. Of the other fourteen miles six are bold and rocky, but, with heavy work, practicable for railway construction; the rest is easy.

Monday, 28*th October*. We were within seven miles of the entrance to the second narrows, the weather looked threatening a storm, and we were afraid to take our small skiff any farther, we therefore took everything out of the larger boat to the Camp, and with a good crew, under Mr. Barker, rowed up to the second narrows (79 miles from foot of lake); here I had a fine view of the lake up the narrows (N. 45° E. magnetic) twenty miles to the last bend of the lake where it runs due north, six or seven miles to its head;—we rowed about for an hour, so that I obtained views from several points, and I completed my sketches for the rough map of the lake which I shall furnish you with. This narrow part of the lake is hemmed in by bold rocky mountains, the cliffs along the shores rising 300 feet to 800 feet in height, in some places overhanging. My impression is that the lake here passes through the Cariboo range, for directly westward were the snow capped peaks that had been on our left (north) all the way up the lake, and a little to the south of east were the peaks, apparently of the same range between the Thompson and Clearwater, and which, continued, form the Gold range west of the Columbia river. There were no very high mountains visible northwards.

Mr. Barker confirms this,—he says that the Niagara river enters the north east side of the lake three or four miles from its head, that the falls of this river, entering the lake, are about 200 feet high, and for four miles up from this the river is very rapid, then there is dead water for about forty miles, in a wide swampy basin, where the Indians hunt beaver, &c.

From repeated readings of the aneroid, I estimated Quesnelle lake to be about 2580 feet above sea level.

At the head of the narrows there are two or more ridges, or terraces, apparently 400 to 600 feet above the level of the lake, and running parallel with its upper arm, nearly north and south. From these terraces, Mr. Barker had a view of twenty to thirty miles through a valley or pass bearing southerly, by which he was informed the Indians travel, from Quesnelle lake to the Horsefly river.

The Clearwater river rises in a range of mountains to the north-east of Quesnelle lake, and nearly due east of the latter it expands into a lake, which can be reached by a pass (the entrance to which I saw) said to be easy and not very high. There is then only the short space between Clearwater lake and the north or Carriboo fork of the Thompson river, about which I can get no information, more than that there certainly is a pass. I have only met one Indian who had travelled over it some years ago, when he was too young to retain any clear recollection of it. This is undoubtedly part of the Selkirk range, and I have no expectation that a railway could be got through it without a tunnel of considerable length, but this route would shorten the line so much that it is well worth consideration.

Before I had completed my sketches a stiff breeze came up the lake and we had a hard pull back to camp; afternoon it calmed down and at two p.m. we started on our return journey, and made Slate Island camp the same evening. (Camp No. 8.) The snow had been gradualy creeping down the mountain sides and next morning it fell within 200 ft. of the level of the lake, and everything indicated an impending storm; the wind had set in to the east which was fair for us, and though the lake was rough, all went well and at 10 a.m. on Wednesday we passed Lipsitt island; it was too rough to cross over to Nim's point, so we followed the south shore round the headland to the mouth of Horsefly river; here we lay two hours till it calmed, when we crossed over to the headland shooting out from the left bank of the Horsefly, and round the same to Mitchell's landing, on the south shore, where we camped (No. 9), sheltered from the storm that now swept furiously down the lake. Next day, 31st October, we reached the foot of the lake where we found a pack train returning to the forks unloaded; by this we sent our luggage and camp equipage, and we followed on foot to the forks and camped (No. 10.)

We made this trip from the forks of Quesnelle and back in eight days, but I regret that we could not go through to the Thompson river as it was too late in the season.

We had to wait at the Forks till our pack train came up from Beaver lake; we then set out homewards, and by noon of the 5th November arrived at the 150 mile house. It had been bitterly cold at our last camp (No. 12,) and now a heavy snow storm set in which lasted two days.

Here I learned that the R and V parties had joined their surveys in Bridge creek valley, and that the Q and W parties were within a short distance of each other in the valley of Chimney creek. I also had a letter from Mr. John Trutch, stating that the T party had arrived at Kamloops, from the Yellowhead pass, and that the U party would complete their survey to Nicola river in a few days.

I immediately drove down to the 127 mile house, near which I found the W party camped, and next day the Q party came in, having completed their survey, and joined their line to that of the W party.

Thus an unbroken line of instrumental survey, was completed from the Pacific coast at Bute inlet to the summit of the Yellow Head pass in the Rocky mountains, and another line from a point in the above (at the junction of the Clearwater and Thompson rivers) to Fort Hope on the Lower Fraser; and before the end of the year a line of levels was continued from Fort Hope to Pacific tide water at N. Westminster. Also a complete survey from the head of Bute inlet down its western shore, thence across the channels and Stewart and Valdes' islands to the western shore of Seymour narrows, on Vancouver Island, making a total of eight hundred miles surveyed this season, exclusive of trial lines abandoned and many hundred miles of explorations.

RETURN TO VICTORIA.

Thursday, 7th November.—I had arranged for the conveyance of the surveying parties to Yale, whence they could get to Victoria by steamboat. Some of the parties were now on their way, and the others preparing to start; the packers were collecting the stores from various points to the depot at 150 mile house, to which I now returned and made arrangements with the proprietor, Mr. Bates, to take charge of those, and also of the pack animals during the winter.

I then took a small party and went to examine the lines that had been surveyed across the Fraser, near the mouth of the José river and Chimney creek, but on arriving at the Fraser we found so much ice coming down that it was not safe to cross; we camped by the side of the river, and next day the quantity of ice coming down was much increased. Thermometer 20° below zero: a band of horses and mules that we had sent up to Soda creek, to be put across the river by the steamboat, returned, as the steamer had not come down, but was laid up for the winter some miles above.

We therefore returned to the 150 mile house, and I remained there till everything was stored and the packers paid off and sent home.

Monday, 18th.—We started homewards in a large sleigh provided by Mr. Bates. At Clinton the party went on by the stage, but I remained over a day to settle some business. At Cornwall's I met Mr. Watt, just returned from Kamloops; all the other parties above alluded to were now before us, and on the 25th November we arrived at Yale, thence by the steamer "Onward" (the last trip of the season) to New Westminster, and next day by the "Enterprise" to Victoria.

EXPLORATORY SURVEY FOR LINE OF RAILWAY ON VANCOUVER'S ISLAND.

Remaining in Victoria till the surveyors were fairly at work on their plans and profiles, I left on the 10th December by the steamer "Sir James Douglas" on her regular trip to Comox, where we arrived the same evening. The steamer was then put at my service to visit the surveying parties on Valdes island, where we arrived on the evening of the 11th and anchored near the camp of the X party—Mr. Gamsby in charge—I spent several hours in the camp examining plans and profiles. I then instructed Mr. Gamsby to continue his surveys, by a line which I marked on the chart, towards Seymour narrows, and endeavour to connect with Michaud's party (Y) who had gone there a few days before to work back, and to whom I sent an Indian messenger with instructions respecting the arrangements I had made.

Next morning at daybreak we started down the strait (noting the character of the shore on our way) till we arrived off Comox, where Mr. Horne (in charge of the Hudson's Bay Co's. post) met us with a canoe and some Indians, which he had engaged for us for our trip up the Courtenay river. Here we left the steamer and proceeded to the Company's store to complete our party and outfit; the same evening we procured a canoe and went about two miles up the river and camped (No. 1) on the right bank. The party comprised myself and Mr. John McLennan (of the Commissariat) three Indians and a Kanaka (Sandwich Islander).

It had been my intention to cross Vancouver island by the great Central lake and Somass river to the head of the Alberni canal (Barclay sound) and return by Horne lake and Qualicum river; but I could not get Indians to go with me, they said it was too late in the season, and indeed the mountains were already covered with snow well down their slopes; and these four were all I could get to go with me, and they only agreed to go to the head of the first lake.

Saturday, 14*th December*.—We started soon after daybreak, leaving our canoe, as the river above this point is a succession of rapids and not navigable. The Indians carried our blankets, stores, &c., on their backs, and our progress was slow, as we followed the banks of the river, where there was hardly any trail, but a good deal of fallen timber, and, in swampy places, a thick undergrowth of brush; we made about seven miles and camped—No. 2.

Next morning, after travelling about a mile and a half, we reached the outlet of Farquhar lake, where we made a raft and crossed to the north bank; then, to avoid the rocky bluffs which project into the lake and prevent a passage by the shore, we took a line that led us a considerable distance inland, among the hills and to heights from three hundred to six or seven hundred feet above the level of the lake; the travelling was pleasant as these hills were covered with grass and dotted with trees singly or in clumps, but the country is much broken up by numerous ravines which we threaded by the assistance of the deer tracks; In less than an hour six deer had crossed our path, one of which the Indians shot and dressed for our use; we then descended by a ravine, and at 3 p.m. reached the shore of the lake about four miles above its outlet—here we camped (No. 3.)

Monday, 16*th December*.—I left Mr. McLennan and three men to construct a raft, and taking an Indian and a gun with me, I followed up the lake several miles; we started several deer, a black bear and an elk; leaving the Indian to hunt the latter, I ascended the mountain rising from the bend of the lake to the height of 1,600 feet above the level of the sea. From this point, I could see several miles up the valley, at the head of the lake, and with my telescope could trace the depression, in which lies the chain of small lakes forming a pass between lake Farquhar and the great Central lake, the surplus waters of which flow by the Stamps and Somass rivers into the Alberni canal, on the west coast of Vancouver Island.

This is one of the routes, and probably that affording the best grades, by which the west coast of Vancouver Island could be reached by a railway in connection with the Bute inlet route across the mainland. Commencing at Seymour narrows, where the mountain slopes come down in a rugged line to the waters edge and rounding Menzie's bay, a plain extends along the shore of the strait to Courtenay river, narrow at first, then expanding to six or seven miles in breath, and—as seen from the deck of the steamer—apparently rising fifty to one hundred feet above the sea level. A great part of this plain is densely covered with timber, but approaching the Courtenay river, there is a considerable quantity of prairie land, and on the river some fine farms are under cultivation.

So far, the country from Seymour narrows is very favourable for a line of railway; ascending the Courtenay river to Farquhar lake, there is a rise of 250 feet in about six miles; but keeping in the gravel benches close to the river there would not be much heavy work in constructing a railway; this valley is timbered with fir, hemlock, cottonwood, cedar and a few white pine, generally of large size.

The line would then follow the north shore of the Farquhar lake, and at two or three places would encounter rocky cliffs of irregular outline, half a mile to a mile in length, and so high that probably some tunnelling would be necessary, and a considerable amount of rock excavation.

This lake passes through the Beaufort range of mountains; the hills beyond do not appear so high, and swell with a softer outline, but the pass looks narrow, and I should expect some rather difficult work before reaching the great Central lake, and also on the shores of that lake, though the Indians assured me the banks were not very high.

Having completed my observations I began to descend, and met my Indian, who had shot two deer, but the elk had escaped him; we reached the camp about two p.m., and found the raft completed; after lunch we embarked, and it being calm we went along rapidly and had a fine opportunity of observing the character of the shore, which for about two miles is very rough: bold cliffs in many places projecting into deep water; in two hours we reached the outlet of the lake and began to descend the river, but had scarcely gone a mile when we came to a fall or short rapid over twenty feet in height; we left our raft and set it adrift, it stood the shock, but sheered over to the other side and got fast among some driftwood, so we had to tramp again; night coming on we camped (No. 4), and next day without any incident we reached our canoe and camped (No 5.) A sharp frost had set in and it was very cold, but with a good fire and some Indian and Kanaka songs, the long evening passed pleasantly.

Wednesday, 18th December—We paddled to the Hudson's Bay Co's. post, and settled our account, then down the bay and camped (No. 6) on a point opposite the steamboat anchorage, to await the arrival of the "Sir James Douglas."

Here we found the Y party encamped—they had arrived from Valdes island at two a. m. this day. The "Sir James Douglas" arrived in the evening, and I arranged with Captain Clarke the day for him to go to Valdes island to bring off the party X. I then discharged our Indians and sent off a canoe with provisions for Gamsby, and instructions where to be with his party on the day fixed by Captain Clarke for bringing them off.

Next morning we embarked on the "Sir James Douglas" and started for Nanaimo at daybreak, Captain Clarke kindly keeping a course that gave me the best opportunity of inspecting the coast between Comox and Nanaimo.

I found this a densely wooded plain, similar to that between Seymour narrows and Comox. Passing the Qualicum river, I could trace the pass by Horne lake to the Alberni canal, which I think would present some very heavy grades for a railway, as the pass looks high and the distance across is short.

Approaching the harbor of Nanoose, the line would have to be taken some distance inland (as I have laid it down on the chart) to avoid a high hill that lies close to the shore, but behind which the land falls off to a lower level. We arrived at Nanaimo in the afternoon, left the steamer and went to a hotel.

Friday, 20th December—We hired a horse and waggon, and drove, on the road to Nanoose, about six miles to Dunsmoor & Diggle's coal mine, taking levels with the aneroid. The country is broken and hilly near Nanaimo, and there would probably be some rather stiff grades, but not very heavy work. At Nanaimo we took in supplies, engaged a canoe and three Indians, and on Saturday morning started them down the strait with our luggage and stores, with orders to be at the head of Oyster harbour on Sunday morning.

I engaged another canoe, and, accompanied by Mr. Ferguson, junior, we paddled along the shore of the strait and up the Nanaimo river to the bridge; thence we went on foot by trail to his father's farm house in the woods, a few miles from Oyster harbour, where I stayed over night. Next morning we walked to the head of Oyster harbour, about four miles of a rough tramp, without any trail; our Indians were not there, but an Indian family were just starting for their village, about three miles down, on the tongue of land forming the north side of the harbour; we went with them and there found our men.

Mr. Ferguson left me here. It was now very cold, with a stiff breeze, and we had a hard pull (some two miles) across the mouth of the harbour; then along the shore against a strong headwind, with hail and snow. At sunset we camped by the side of a stream on a sheltered spot.

Monday, 23rd December.—It had been very stormy all night, and on rising this morning, we found the ground covered with over a foot of snow, and it was still falling fast. We breakfasted at daybreak and started. After paddling two hours in a heavy swell, we entered Horseshoe bay and got shelter in the house of Mr. George Askew; the snow fell heavily all day, and it was now too deep to continue the survey at present, so I paid off the Indians and they started for home with a fair wind.

Next morning, the "Maude" steamed into the bay with Mr. John McLennan on board, whom I had left at Nanaimo with instructions to come by this steamer and pick me up somewhere on the coast; we arrived in Victoria, at 5 p.m. Christmas eve.

At Nanaimo, the land is high and the railway line would have to be taken either close to the shore, where it is much broken up by deep ravines, or up near the coal mine, with probably a steep grade down to the Nanaimo river; thence to the head of Oyster harbour, the ground is generally low and tolerably uniform.

From Oyster harbour, the mountain slopes come to the water's edge, and the line would have to hug the shore till within a short distance of Horseshoe bay; it would then strike across a tongue of land and touch the head of the bay, then be deflected inland to avoid a range of hills lying on the coast between that and Cowichan; there would probably be some stiff grades between Horseshoe bay and Cowichan, but not very heavy work.

On the 24th February, 1873, I resumed my survey of the coast line and, accompanied by Mr. John Trutch, went over the country between Esquimault harbour and the head of Saanich inlet; the distance is about eight miles; in the middle lies Langford lake, on a plateau about 200 feet above the level of the sea. The greater part of the ascent from Esquimault harbour would have to be made in a distance of two or three miles.

The descent to Saanich inlet is all within about the same distance, by a narrow valley or canyon; but as there is no object in getting down near to the water level at the head of the inlet, the line might be taken well up the slopes to reduce the grade; the slopes are however rocky and in some places very irregular.

March 1st.—On board the steamer "Sir James Douglas," Captain Clarke, I completed the reconnoissance from the head of Saanich inlet along the west shore to Mill creek, where the line from Cowichan would come in, as shewn on the chart. On the whole of this distance, about twelve miles, the rocky slopes of the mountains come down to the water's edge. On the first six miles from the head of the inlet, the rocks are precipitous, irregular and broken in outline, so that there would be heavy rock excavation and one or more short lengths of tunnelling. On the remainder of the distance, the inclination of the slopes is easier and the coast line more regular, so that the work of construction would be comparatively light.

From Mill creek to Cowichan the irregular broken line of the coast could be avoided by running a line one to two miles from the shore, as shewn on the chart, where the land appears comparatively low and uniform; this would shorten the distance and avoid some heavy works.

On the whole, the country from Seymour narrows to Nanaimo, about 98 miles, is very favourable for a line of railway; the excavations of rock and earth would not be heavy, and the only bridging of importance would be over the Courtenay and Qualicum rivers, neither of them over 60 yards wide.

From Nanaimo to Cowichan harbour, about 35 miles, the excavations would be rather heavier, but the bridging light.

From Cowichan to Esquimault, twenty-five miles, the rock excavations would be heavy.

Taking the whole line from Seymour narrows to Esquimault—about 160 miles—the average of the works would be moderate, and I think lighter than the average of those of the Intercolonial Railway. I have laid down the projected line of railway from Seymour narrows to Esquimault, on the Admiralty charts herein referred to, sufficiently close for all present purposes, so there is not much need for any further surveys in this quarter until actual construction is authorized.

GENERAL PHYSICAL FEATURES OF BRITISH COLUMBIA.

To assist in explaining the character of the several lines surveyed and explored, a brief description of the position of the mountains and rivers in British Columbia is necessary; but this, from the limited information we have at present, must be very general, only noticing such subdivisions or minor mountain ranges as have come within the scope of our surveys and affected the courses of the lines surveyed.

The great mountain zone, running parallel with the shores of the Pacific Ocean, which distinguishes the western side of the North American Continent, may be said to consist of two distinct chains, each chain composed of several separate ranges, not always continuous, but very irregular and broken; sometimes having the appearance of separate mountains grouped in various lines, straight or curved; and, especially in the Cascade chain, often presenting an irregular wild sea of mountains.

These mountains do not, as is generally supposed, decrease in height towards the north (at least up to the 55th parallel of latitude).

On the contrary, the peaks of the Rocky Mountains are higher in British territory than farther to the south, some of them, it is said, rise 12,000 to 16,000 feet above the level of the sea.

But the valleys or passes are much deeper in the north, thus affording better lines for road or railway; they are, however, generally narrow at the bottom, with a rapid river flowing through, and covered with a dense growth of timber, rendering them difficult to explore or survey.

First.—The coast chain, generally called in British Columbia the Cascade range, and southwards the Sierra Nevada.— runs generally parallel to the coast; although south of the 49th parallel, in California and other states, there are intervals of broad plains between the Pacific Ocean and the foot of the mountain slopes; but northwards of the mouth of the Fraser river, along the whole coast of the mainland of British Columbia, the mountain slopes come sheer down to the waters of the Pacific.

Secondly. The Rocky Mountain chain, apparently running parallel to the other, but really converging towards the north, till they ultimately become one chain. The distance between the axis of the two chains on the line of the Union and Central Pacific Railways is about 900 miles, while on the lines surveyed for the Canadian Pacific it varies from three to four hundred miles.

Between these two chains is an elevated undulating plateau, ranging from three thousand to four thousand five hundred feet above the level of the sea. This is much broken by lakes and spurs from the main mountain chains and inferior parallel ranges, and by deep valleys, through which flow the rivers on their course to the Pacific Ocean.

The breadth of the coast chain on the lines which we have surveyed is from 100 to 120 miles from the inlets of the Pacific coast on the west to the foot of its eastern slope. The western slope is indented with numerous fiords or deep water arms of the sea, running 30 to 60 miles into the mountain chain, and the main ranges are a chaos of bold rugged mountains of bare rock rising abruptly and terminating in irregular masses of snow capped peaks from 6,000 to 10,000 feet above the level of the ocean.

On the eastern slope of this chain and extending on the plateau between it and the Rocky mountains, is a belt varying in breadth, but probably averaging over one hundred and twenty miles, which is sheltered from the rain clouds coming from the west by the great elevation of the Cascade mountains; on this but very little rain falls, and there is consequently scarcely any underbrush, and the larger trees, chiefly firs, are thinly scattered singly or in clumps, giving the whole country a park-like appearance. This is the celebrated bunch-grass region on which there seldom falls more than a foot or eignteen inches of snow; and cattle, horses and mules, are pastured out on it all the winter, getting no other feed but what they can pick up from the bunch-grass and white sage, or wormwood, that grows on the slopes of the hills. This belt extends at least as far north as the Chilcotin lake, beyond the 52nd parallel, but there the grass is inferior, and southward it extends far into United States territory.

On the western slope of the Rocky mountains, and on the high plateau between them and the coast chain, several large rivers have their sources. Those flowing westward or southwest have cut their way through depressions in the coast chain to the Pacific ocean. The Peace river alone has cut directly through the Rocky mountain chain and flowing northeasterly joins the Mackenzie, which issues in the Arctic ocean. Of those flowing westward, the principal are the Naas, Skeena, Bella Coola, (flowing into the Bentick arm,) Homathco (into Bute inlet) and the Fraser. The Columbia river also flows through the coast chain, but although it rises in British Columbia its lower course is in United States territory.

It is obvious that, by following the course of one of these rivers the nearest approximation to a uniformly descending grade from a pass through the Rocky mountains to the Pacific coast will be obtained.

But unfortunately, though the rivers (especially the Fraser) descend with tolerable uniformity, the valleys in British Columbia—everywhere narrow—do not leave much margin between the rivers and the foot of the slopes of the hills or high plains that bound them; and as the rivers roll onward to the ocean, cutting deeper into the earth, this margin becomes more and more contracted till, on entering the foot hills of the Cascade chain, it entirely disappears, except where depressions have been made by lateral streams, and the valley becomes a mere gorge or trough, the slopes of its banks rising in a succession of benches of clay or sand mixed with gravel or boulders, with here and there a rocky spur or bluff protruding into the river These benches rise from 200 to 1,000 feet above the level of the river, and where they consist of drift clay sometimes come down in great masses after heavy rains, and for a time dam it up. In places the benches have entirely disappeared and the slopes rise directly from the water's edge from 1,000 to 2,000 feet in height, at various angles, according to the compactness of the materials of which they are composed. Down these slopes, boulders, gravel and disintegrated rocks from the mountains above, are ceaselessly rolling, rendering it very difficult and expensive to construct a railway and maintain it afterwards.

In passing through the main ranges the river sometimes rushes in a torrent for miles between perpendicular walls of solid rock, from twenty or thirty to several hundred feet in height; this is called a canyon; sometimes the rocky slopes are tolerably uniform, but often they are broken with bold projecting spurs and deep lateral chasms.

The benches mentioned above—of which there are generally three on the Fraser and its larger tributaries—evidently mark the height of the water at successive periods. I noted similar benches being formed on the edges of lakes and the still water of rivers, by the fragments of rocks that are continually rolling down the slopes of the mountains. The upper benches of the Fraser and its tributaries, more than 150 miles apart, I found by repeated readings of the Aneroid, to be all about the same level, viz: 2,400 feet to 2,500 above the level of the sea. So that these rivers at some remote period must have formed a connected series of lakes, amongst which the higher lands would appear as islands.

As these rivers at successive periods burst through some rocky barrier in the Cascade chain (possibly assisted by volcanic action or other disturbing cause) they would subside to the level of another barrier and form new benches on their margin, and so the process continues, the rivers constantly approximating nearer to a uniform inclination throughout their course to the ocean.

The Fraser at present has the nearest approximation to uniformity of descent, but the process is going on rapidly in other rivers as described in my survey of the Homathco canyon. In the earlier periods there must have been waterfalls in the Cascade ranges of awful grandeur.

I have stated that the Peace river flows through the Rocky Mountain chain, and this is certainly the lowest pass through these mountains. The Giscome portage, between its southern source, at Summit lake, and the Fraser river, is 8 miles in length, and less than 2400 feet above sea level. So that taking a point well down on the Peace river east of the Rocky Mountains and following that river up to its Southern source, then across the Giscombe portage to the Fraser river, and descending the same to Pacific waters, is undoubtedly the line of lowest altitude from the plains of the Northwest territory east of the Rocky Mountains to the Pacific Ocean.

There is another line branching out of this, said to be of comparatively low altitude, viz:—

From McLeod's lake near the Southern source of the Peace river, westwards by Stewart's Lake and up the Nechaco river to a chain of unexplored lakes extending to the Cascade chain of Mountains; following these the line would then pass through the mountains by the Dean river and channel to the Pacific Ocean.

But of this route, scarcely anything is known except from the crude reports of Indians.

The only reliable information we have of this part of the country is from the report of an exploratory survey by Lieut. Palmer, R. E., in 1862, from the Bentick arm, by the Bella Coola river, and across the Chilcotin plains to Fort Alexandria, on the Fraser. He found the ascent from the Pacific waters through the Cascade chain to the central plateau so abrupt as to be unpracticable for a waggon road; the plateau at the head of the precipice being 3,840 feet above the level of the sea.

The Bentick arm and the Dean channel are two branches of the larger channel entering the Pacific by Fitzhugh sound.

The Dean channel and river pierce the Cascade chain 30 to 40 miles farther north than the Bentick arm and Bella Coola river, but the country traversed by each is in all probability very similar in character.

There are several passes through the Rocky Mountain chain, giving access from the North West Territory to British Columbia; some of these are too far south to be eligible for a line of railway to the Pacific coast within the boundaries of that Province.

Of those which are more favourably situated, I give the following with their approximate altitudes above the level of the sea, commencing with the most southerly and taking them in consecutive order northward, viz:—

1	Howse pass	Altitude	4,500	feet.
2	Athabasca	“	6,025	“
3	Yellow Head	“	3,746	“
4	Smoky River	“	not known	“
5	Pine River or Indian pass	“	“	“
6	Peace river	“	under 2,000	“

We have surveyed the Howse and Yellow Head passes only, and with the latter all the surveys of 1872 were connected.

The eastern slope of the Rocky Mountains, from the foot of the main rocky ranges is a long gently inclined plain or series of steppes, and either of the above passes could probably be reached from the east with moderate grades. But on the western slope the country is much more difficult. The Athabasca pass is too high to be considered eligible for a railway route. The Howse pass debouches on the Upper Columbia valley, almost at right angles to it and with a ver rapid descent, as shewn by the surveys made of this pass in 1871 ; and a there is little probability of a pass being found across the Selkirk rang between the upper and lower arms of the Columbia river, a line o railway through the Howse pass would, on entering the Columbia valley have to turn at a sharp angle and follow the course of that river on a nort west course about 100 miles to the great bend, at the Boat encampmen and there make another sharp turn, and run in an almost opposite directio for about 85 miles to the Eagle pass, through the Columbia or Gold range by which a connection could be made with the valleys of the Thompso and Fraser.

The situation of the Yellowhead pass is much more favorable. It i entered from the east by the valley of the Athabasca to Jasper House ; i then follows up the same valley nearly due south to its junction with th Caledonian valley, thence up the latter, due west to the summit of the pass Beyond this the valley continues westward by a gentle descent to Yellow head and Moose lakes. These lakes receive the first tributaries of th Fraser, and from Moose lake that river issues in a stream 50 to 60 yard wide, which is joined by another branch of greater magnitude from th north before it reaches Tête Jaune Cache. Here it encounters the Selkir range, or an apparent continuation of the same, sometimes called th Cariboo range, by which it is deflected to a northwest course, in which i continues nearly 200 miles through a deep valley, completely severing thi range from the main chain. Having turned this at the great bend, th river then flows almost due south for nearly 400 miles, thence westwar till it enters the Strait of Georgia below New Westminster.

Standing on an elevated point near Tête Jaune Cache, the deep va ley of the Fraser is seen stretching away to the northwest as far as th eye can reach ; then, facing round to the opposite direction, the valley continued almost in a straight line by the Canoe river to the great bend the Columbia, at the Boat encampment; thence up the Columbia in t same direction to its source; and thus the great chain of the Rocky Mou tains is cleft longitudinally by a continuous line of deep valleys over 4 miles in length.

The portion thus severed from the main range is scarcel inferior to it in altitude, and is equally rugged and broken ; it is th terrible snow peaked range seen stretching away from Tê Jaune Cache, so graphically described in Milton and Cheadle's " Northwe Passage by land."

On the westerly flank or foot hills of this range are the gold bearing rock extending south easterly to the boundary of British Columbia, and nort westerly in the same line as far at least as the 56th parallel of latitude, an probably much farther. Fortunately, there is a remarkable depression i this range, affording an eligible line for the railway from the Fraser valle at Tête Jaune Cache—by Cranberry and Albreda lakes—to the nort branch of the Thompson river.

This depression or gap is from three to four miles wide from Têt Jaune Cache to the crossing of the Canoe river, and its elevation is no much higher than that of the Fraser valley; thence to Albreda lake th valley is narrow and more elevated as it crosses the water-shed between the tributaries of the Fraser and Columbia rivers.

The north branch of the Thompson river rises within 35 miles of the bend of the Fraser, at Tête Jaune Cache, and flows south easterly, while the Fraser takes a directly opposite course, and the two rivers, after flowing many hundreds of miles, unite at Lytton, having circumscribed an egg-shaped space about 300 miles in diameter from north to south, and 120 miles from east to west; this space includes the Cariboo mountains, and the whole of it has a high elevation, indented with numerous deep valleys and lake basins.

The direct line to connect the Yellowhead pass by railway with Bute inlet, would cross near the centre of this space from east to west, and it is here that we have met with the greatest difficulty on account of the great difference between its altitude and that of the Thompson and Fraser valleys which enclose it.

The Quesnelle lake and river, and the Horsefly and Beaver valleys, offer eligible lines, but the heads of these are separated from the Thompson river by a very high mountain range, across which we have not yet found a practicable pass. The line surveyed is from fifty to sixty miles farther south, which considerably lengthens the distance, and has other objectionable features, which will be seen in the description of the several lines surveyed.

The Fraser river and its tributaries drain an area of nearly 100,000 square miles; it is on the eastern and southern portion of this space, and in the Homathco valley, flowing into Bute inlet, that our surveys and explorations in British Columbia have been made this last year, embracing the leading features of mountain and river over an area of about 40,000 square miles.

DESCRIPTION OF THE ENGINEERING CHARACTER OF THE LINES SURVEYED.

Yellowhead pass Eastward.

Our surveys make the summit of the Yellowhead pass 3746 feet above the level of the sea.

Plans and profiles have just come in from Mr. Walter Moberly, the engineer in charge of the S party, who are working from the summit of this pass, down the eastern slope of the Rocky Mountains, towards Edmonton.

From the summit, the line follows the Miette River down the Caledonian valley to its junction with the Athabasca, a distance of 18 miles, with a total fall of 352 feet.

In the first nine miles and a quarter the fall is only 141 feet, with light work; in the next two miles the fall is 120 feet, but by a slight deviation of the line a grade of 1 per 100 can be obtained without heav works. The rest of the distance to the Athabasca is by easy descendin grades, nowhere exceeding 30 feet per mile, and the works will not heavy.

The line follows down the left bank of the Athabasca river, elev miles, where it crosses, and then follows the right bank. The grades this portion are easy, and the works will be light; but just below t crossing the river washes the foot of a range of high rocks for nearly mile, on which there will be some rather heavy rock cutting; then down to the crossing of Rocky river, opposite Jasper House, the grad will be remarkably easy and the works light. The distance from t summit of Yellowhead pass to this point is 40 miles and the total fall 4 feet, making an average descent of 11 feet per mile.

From Rocky river the line runs across low sandy flats for a mile a a quarter, where it strikes the foot of Miette rock, which is washed by t overflow of the Athabasca for about a mile and a half. On this porti there would be some very heavy rock excavation, but it is an open qu tion whether the line should not be kept on the other side of the river this point is passed, so as to avoid the heavy work here, as well as at a po further up, also the bridging of Rocky river.

The survey at the date of Mr. Moberly's despatch, 27th Februa 1873, was carried six miles beyond Miette rock to Fiddle river. The to distance from Yellowhead to this point is 49 miles, and the fall 442 fe the extreme points of the last 8½ miles being on the same level, connect with undulating grades. The works on this portion will be light.

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BRITISH COLUMBIA SECTION.

YELLOWHEAD PASS WESTWARD.

******From the Yellowhead pass by the Thompson and Fraser rivers to Burrar inlet, on the Pacific coast.*

From the summit of the Yellowhead pass the line follows down t valley nearly due west to the head of Moose lake, 18½ miles, in which t fall is 344 feet; on the first 2½ miles the fall is about 45 feet per mile Yellowhead lake, thence along the shore of the same 3½ miles level, leavi the average fall for the rest of the distance 20 feet per mile.

The line follows the north shore of Moose lake 8 miles to its out at the west end; on this there are easy undulating grades. The wo from the summit of the pass to this point, 27 miles, will not be heavy.

From the outlet of Moose lake there is very little fall for a mile an half, but thence to Tête Jaune Cache, 18 miles, the Fraser falls 924 f giving an average of over 51 feet per mile.

Mr. Mohun, the Engineer in charge of T party, ran the line along t trail on the north side of the Fraser in order to reach the summit Yellowhead pass before the winter set in; and his profile shows approximation to a line which could be obtained by more careful surveys, but it gives the altitude at certain well defined points from which the average grades can be estimated.

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*This is designated Route No. 2, in the Reports of January, 1874.

At Tête Jaune Cache the line leaves the valley of the Fraser and turning almost at right angles follows up a valley on a southeasterly course to Cranberry lake. The distance from Moose lake to this is about 32 miles and the average descent 26 feet per mile. By crossing the Fraser near the foot of Moose lake and running down its south bank a line to Cranberry lake, with grades approximating the above, it is believed could be obtained.

It is not expected, however, that the work will be light on this section as the sides of the Fraser valley are rough with bold bluffs and steep slopes, and about ten miles of it runs through slate rock.

From Cranberry lake to the crossing of Canoe river, 3½ miles, is practically level, as the surface of the river is only 20 feet below that of the lake; thence to Albreda lake, 10 miles, there is a rise of 264 feet. This is on the watershed between the tributaries of the Thompson and Columbia rivers, and, by our surveys, is 2,866 feet above sea level. The works on this section will be light. From this lake, the line follows the Albreda river to its confluence with the north branch of the Thompson, a distance of eleven miles, in which the descent is 430 feet. For about half the distance, the grade on the line surveyed exceeds one per 100, but by a slight deviation of the line, the grade can be reduced to that or probably a lower rate of inclination.

At the mouth of the Albreda river, the line crosses the north branch of the Thompson and follows down its right or west bank near to its confluence with the Clearwater, where it re-crosses to the left bank at an angle of about 45° with 400 feet of bridging.

In this distance of 98 miles, the river falls 1,080 feet; this fall is not uniform, but in no case will the grade exceed 1 per 100; curves of five degrees, or 1,145 feet radius, will have to be used in several places. The general character of the works on this portion will not be heavy, as the line runs on low flats for about one fifth of the distance, and the rest on gravel benches, or on the face of easy slopes; with the exception of about eight miles through the canyon, where the work will be heavy. Two-thirds of the distance through the canyon is slate rocks with short cuttings of 20 to 30 feet maximum depth; the balance will be very heavy rock cutting, with a considerable length of tunnelling; but by bridging the river twice, the tunnelling can be reduced to one of 300 feet and another of 800 feet in length.

About four miles above the mouth of the Clearwater, the line to Bute inlet branches off. The altitude at that point is 1,397 feet above sea level.

From Clearwater, the line follows the left bank of the north branch of the Thompson river to its junction with the south branch, where it crosses the latter with 300 feet of bridging, altitude 1,170 feet above sea level. It then follows the left bank of the united streams to Kamloops, about a mile lower down.

In this distance of 73 miles, the river falls 191 feet, or under three feet per mile.

The grades of the line are easy and undulating, only varied in passing from one bench to another of different height, or in rising over a rocky spur to reduce the quantity of excavation.

The heaviest work in this section commences about 11 miles below the mouth of the Clearwater, and continues for about four miles, in which there are a number of spurs of compact slate rock to be cut through, in lenghts of 300 to 800 feet, and from 15 to 30 feet maximum depth: amongst those is the Assiniboine bluff, 700 feet in length, of which about 500 feet will have to be tunnelled.

Below this, at various points, the high benches of clay, gravel or shale, come very close to the river, and in these there will be some heavy cuttings in short lengths, the lower portions of which will be in slate rock; there are about eleven miles in which this class of work occurs.

The rest of the distance, the line runs on benches and low flats, and the works will be light; altogether this section of the line is very satisfactory, and the works on the average will not be heavy, but medium, and might almost be classed as comparatively light.

The distance from the summit of the Yellowhead pass to Kamloops is 255 miles; this, with 45 miles surveyed eastward, from the same pass to Lac à Brulé, beyond Jasper House, making a total length of 300 miles of line, in which is embraced the whole of the Rocky Mountain chain, which cannot be considered as other than remarkably favourable.

The work on the average is not heavy and far lighter than could have been expected in view of the gigantic mountains which hem in the valleys, often threatening to bar a passage altogether. On the whole of this three hundred miles there need be no grade of a greater inclination than 1 per 100 or 52.80 feet per mile, and the whole line is on a comparatively low elevation, the highest point being 3,746 feet above the sea level.

On the Union and Central Pacific railroads, in the United States, more than a thousand miles of the line is above that level, and at several points it reaches more than double that height.

After the junction of the two branches of the Thompson river, near Kamloops, the joint current flows nearly due west for about 40 miles, then southward about the same distance to its confluence with the Fraser at Lytton, and thence the latter flows through the Cascade chain to the Pacific Ocean. The line surveyed follows the left bank of the Thompson river down to Kamloops lake, about seven miles, with easy grades and moderate work; thence along the south shore of the lake: about a mile and a half down it encounters a range of volcanic rocks five miles in extent; on about half this distance, the perpendicular basaltic cliffs project into deep water with very irregular outline; in this section there would be very heavy rock excavation, including a considerable length of tunnelling.

The length of the lake is about 18 miles, and its altitude about 1,130 feet above the sea; from this the line continues on the left bank of the Thompson river, which, as we descend, is a succession of benches varying from twenty to several hundred feet in height, much broken up by deep lateral ravines; and frequently the higher benches come close to the river, terminating in broken slopes of clay, gravel or loose rock, varied at intervals with bold spurs of solid rock shooting right into the river and diverting its course. Altogether this section from Kamloops to Spence's bridge, where the waggon road crosses, a distance of 70 miles, is very unfavorable; on it there would be a number of steep undulating grades and generally heavy excavations and embankments.

From Spence's bridge downwards about fourteen miles the line becomes more and more difficult; thence to the junction with the Fraser at Lytton, and down the latter to Yale, a distance of 65 miles, the valley has all the worst features of rocky canyons, bold bluffs, high benches, serrated with deep lateral ravines, shifting slopes of gravel and loose rock, already described as characteristic of the valleys of those rivers cutting directly through the coast chain of mountains.

The construction of a railway through this section would require an excessive quantity of rock and earth excavation, heavy bridging and long lengths of tunnelling, altogether forming such a continuous succession of very heavy works as to render this line almost impracticable on account of the great cost it would entail; and though this is the line giving the best grades that can be obtained through the Cascade chain of mountains, it should not be adopted till exhaustive surveys are made of all the other most promising passes across this chain of mountains.

From Yale downwards, past Fort Hope, till the Harrison river is passed—about 35 miles—the work would be lighter, but should still be classed as heavy work.

From Harrison river to New Westminister and Burrard's inlet, 60 miles, the valley of the Fraser opens out to several miles in breadth, with very rich low flat lands on either side of the river. The work on this section would be comparatively light, with easy grades, although a good deal of bridging would undoubtedly be required.

The Harbour of Burrard's inlet and the outer basin of English bay are so well known as possessing in a high degree the requisites for a railway terminus that no description here is necessary.

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*Loop Line from Kamloops, by Nicola Lake, to Fort Hope.

This is a deviation of the last line to avoid the worst portions of the Thompson and Fraser rivers, by endeavoring to cross the mountain chain through one of those passes or depressions in the main range, from which the streams flow down either slope in opposite directions—instead of directly through the mountains, like that of the Fraser.

The summit of such passes can seldom be reached without very steep grades, but as the valleys by which they are approached are not so deep, some of the worst features of bold bluffs and deep rocky canyons are avoided, or only met with in a modified form.

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*This is designated Route No. 1, in the Reports of January, 1874.

This line commences at a point on the last line (No. 1) about thre miles above Kamloops, and taking a southerly course for about three mile it crosses the south branch of the Thompson river, thence it follows u the valley of the same nearly due east, ascending the slopes that boun the valley obliquely for seven miles, where it enters the valley of Campbell creek. The grade on the first three and a quarter miles, from th crossing of the Thompson river, rises at the rate of 1 per 100, and on th next three and three-quarter miles, 2.40 per 100, or 126.72 feet per mile

On the whole seven miles the ground is much broken and serrate with deep lateral ravines which, even with these steep grades, would require very heavy cuttings and embankments, and a great number of ver long culverts constructed in the most substantial manner, to carry th heavy embankments; probably some of the deepest ravines would hav to be bridged, as much of the material is unsuited for high embankments.

The average grade of these seven miles is about 92 feet per mile, bu if it were possible to get a line giving this it would be at the expense o still heavier works.

The line follows up Campbell's valley to the summit with ascending grades, none of which need exceed 1 per 100, and with no very heavy work.

This summit is 29 miles from the crossing of the Thompson river, and 2,900 feet above sea level; the line then follows down another valley in a southerly direction to Stump lake, and thence to Nicola lake.

In this distance of 13 miles there are some steep descending grades, and rather heavy cuttings, some of them 30 to 40 feet in their deepest part, but none exceeding 1,500 feet in length, and diminishing in depth rapidly towards each end; by a slight deviation of the line the worst of these grades might be reduced to about 1.25 per 100 for three miles without increasing the work.

Nicola lake is 12 miles in length and its altitude 2,120 feet above se level. The line follows its northwest shore with undulating grades, and some rather heavy rock cutting, including a tunnel 900 feet long.

From the outlet of Nicola lake down the Nicola river to the mouth o the Coldwater is 5½ miles, and thence up the Coldwater valley to Summit lake is estimated 34 miles. No instrumental survey of this section has been made, but Mr. Dewdney, with a division of the V party, made a rough traverse and sketch of the valley, stepping the distances, and taking th heights with the aneroid; he describes the Coldwater as a fine open valley covered with bunch-grass. The average grade on 25 miles of the uppe portion of the valley to Summit lake is estimated at 50 feet per mile, but fo eight miles the grade would be about 80 feet per mile.

The line at Summit lake is 3,520 feet above the sea level, the distance from this by the Coquihalla valley to the Fraser river, at Fort Hope, is 33 miles, and the bank of that river, where the line crosses, is 127 feet above sea level, giving a fall of 3,393 feet, or an average grade of over 100 fee per mile. But it is not possible to obtain a uniform grade without excessivety heavy work.

The best that could be done, according to present surveys, would be, commencing at summit lake and descending to the Fraser with grades as follows :—

1. Grade 3.31 per 100 with rock cuttings and embankments, maximum depth 50 to 75 feet	3¼ miles.
2. 2 feet per 100 with light work	2½ "
3. 1.21 " 100 " "	2¾ "
4. 3.25 " 100 with a continuous tunnel, 3¾ miles long, in rock and heavy embankments	7 "
5. 1.25 per 100 with medium work and one tunnel of about 1,000 feet	9½ "
6. 0.67 per 100 with a tunnel 1,000 feet	2 "
7. 2.13 per 100 with heavy cuttings and embankments and tunnel 7,500 feet	4½ "
8. Nearly level	2 "
	33½ miles.

This gives five miles of tunnelling, which might possibly be reduced by more careful surveys, but the grades are excessively heavy, and such as could not be worked by ordinary locomotives. The snow fall is also very deep in the upper part of this valley.

At Fort Hope, the line crosses the Fraser river, with one thousand feet of bridging, and rejoins that of Route No. 1; the remainder of the distance to Burrard's inlet is common to both.

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From Clearwater Junction, by Canim, La Hache and Tatla Lakes, Bute Inlet.

This line commences at a point on Route No. 1, about four miles above the confluence of the Thompson and Clearwater rivers, and 180 miles from the summit of the Yellowhead Pass, the latter distance is therefore common to both lines.

The distance from this point to Kamloops is seventy-seven miles by the line surveyed, on which a waggon road could be constructed at a very moderate cost. By the river, which is navigable for small craft at certain seasons, the distance is a few miles more.

This line traverses the fertile valleys of Bridge creek and Lake La Hache, crossing the waggon road to Cariboo near the 106th mile from Lillooet. It crosses the Fraser river about 16 miles below Soda creek, from which to Quesnelle mouth, 60 miles, the Fraser is navigable by steamboat in the summer, and there is also a good waggon road all the way; both the navigation and road could be extended from Soda creek to the railway crossing at reasonable cost; this line would also give access to agricultural and grazing lands in the Chilcotin and Chilanco valleys as rich and extensive as any I have seen east of the Cascade range; but there are engineering difficulties on portions of it of a very grave character, which will appear in the following description:

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*This is designated Route No. 4 in the Reports of January, 1874.

The point at which this line commences is 1397 feet above sea level; from this it follows nearly a northwest course across the angle between the two rivers and in less than two miles strikes the left bank of the Clearwater, which it follows up almost due north four miles, then it crosses the river, with 200 feet of bridging, and follows up the right bank 18¼ miles to the mouth of Bridge creek, with an average rise of 18½ feet per mile. On the whole of this distance the line is very difficult, and to keep the quantity of rock excavation within moderate limits, curves of five degrees or 1,146 feet radius will have to be frequently used, and we have put in three curves of 955 feet, and two of 818 feet radius; even with these we have had to adopt steep grades, of which there are eleven miles exceeding 1 per 100, the highest of which is 1.50 per 100 for four miles.

With these curves and grades, the cuttings are reduced to shore lengths, few of them exceeding 1,000 feet, with a maximum depth of 40 feet, and diminishing rapidly towards the ends. The line then follows the valley of Bridge creek, on a westerley course, to the outlet of lake Mahoud, about 3½ miles; this is an exceedingly difficult portion, the valley is narrow, deep and tortuous, hemmed in with walls of basalt and trap rock, and the average rise is 1.44 per 100, with continuous sharp curves and very heavy rock cuttings in which is included a tunnel, through rock, 1,800 feet in length; there is also a ravine to cross, 2,000 feet wide and averaging in depth fully 100 feet below grade line.

Mahoud lake, is 2,074 feet above sea level, and 13 miles in length; the line follows the south shore, and for the first three miles, the grades are easy, and the works will be moderate; it then encounters a bluff of slate rock, a mile and three quarters in length; a large proportion of this is a high perpendicular cliff, extending into deep water with an irregular face; in this there would be very heavy rock excavation, including fully a mile of tunnelling.

From this the high bench at the head of the lake can, by a slight deviation of the present line, be reached with grades not exceeding 1 per 100, but with rather heavy works.

Between Mahoud and Canim lakes the distance is about 5 miles, and the line crosses the connecting stream (60 to 100 feet wide,) about a mile below the outlet of the latter, with moderate works; it then follows up the north shore of Canim lake, 18 miles to its head,—this shore is a serpentine line, requiring frequently curves of 1,000 feet radius with easy undulating grades, but the work will be rather heavy, as the cuttings, though of no great extent or depth, will be chiefly in slate rock.

The altitude of this lake is 2,550 feet above sea level; following up the valley of Bridge creek, the distance is 18 miles to the watershed, between the Thompson and Fraser rivers, 3,104 feet above sea level. The line surveyed is too far up the north side of the valley, and has several steep grades, which could be avoided by keeping nearer to the stream, which would also reduce the works to medium or rather light works. From this summit the line still continues westward, and at three miles crosses the waggon road; thence down the valley to the head of lake La Hache. with no grade exceeding 1 per 100; thence along the north shore of this lake, with easy undulating grades to its outlet, by the José river; the distance from the watershed to this point, is 24 miles and the work throughout is generally light. Lake La Hache, is 2,672 feet above the sea level, and from its outlet the line follows the José valley to Williams lake, 23½ miles, descending with grades of tolerable uniformity, averaging 36 feet per mile, crossing and recrossing the stream, which is about 30 feet wide, several times.

The line follows the north shore of Williams lake, 5 miles in length with undulating grades and not heavy work, thence down the José valley to the Fraser river, a little over seven miles.

Approaching the Fraser, the valley becomes deep and narrow and the descent more rapid, so that grades of 1 to 1.60 per 100 have to be used, but with no very heavy work.

The line crosses the Fraser at an angle of about 45 degrees, requiring bridging 800 feet long and 3) feet above the river level, or 1,374 feet above sea level; it then follows the right or west bank of the river for 17 miles, in which it has to cross the face of some heavy clay slides and high slate rock bluffs, with some grades of 1 to 1.20 per 100; in this section there will be some very heavy works, including two tunnels through limestone rock, one of 1,500 feet and the other 2,)00 feet in length.

A deviation or loop line has been surveyed from the foot of Lake la Hache across the neck of land into Chimney creek valley and down the latter to the Fraser, crossing this river about 7½ miles farther down than the other line. This shortens the distance about nine miles and avoids some of the heaviest work on the bank of the Fraser, including one of the tunnels. This line is generally favourable till within 4¾ miles of the Fraser, in which distance it falls 500 feet, and is then on a bench 325 feet above the level of the river, and is therefore impracticable; but it is possible that by turning down the left bank of the river, and descending gradually, a practicable crossing might be found, and the heavy works on this portion much reduced.

About 17 miles below the mouth of the José river the line leaves the Fraser river and ascends the slopes of the valley obliquely for nine miles, where it enters Riskie's valley; on one half of this distance the work is heavy with a grade of 1.20 per 100, on the other half the work is rather light. From this point the line ascends Riskie's valley with grades of 1.20 to 1.60 per 100 for 13 miles on to the Chilcotin plains, but with light work. For the next 18 miles the work will be very light, with undulating grades, none exceeding 1 per 100; the highest point is 3,700 feet above sea level. The line then descends to the Chilcotin valley, 24 miles, with an average grade of 1 per 100, but in some places grades of 1.20 to 1.30 will have to be use On ten miles of this the work will be rather heavy, but the rest will b light or medium.

A loop line has been surveyed from this point down the Chilcotin valley and up the Fraser, rejoining the main line at the entrance o Riskie's valley; this gives good grades, but excessively heavy works.

The line now follows up the Chilcotin and Chilanco valleys to the outlet of Tatla lake, thence along the north west shore of the same, and up the valley from its head to the summit or watershed between the Chilcotin and Homathco rivers, the former flowing into the Fraser and the latter into Bute inlet. In this distance of 68 miles the grades are very easy and the work will be generallly light, the only exceptions are one rock cutting of 600 feet feet and another of 2,000 in length.

The height of Tatla lake is 3,011 feet, and that of the summit last referred to, 3,117 feet above the sea level. From this point the line takes a southerly course, entering the Cascade mountains by a chain of small lakes, nine miles to Bluff lake, descending with easy grades, and the work will not be heavy with the exception of one rock cutting 800 feet long and of a considerable depth.

From the head of Bluff lake for 35 miles down the Homathco valley, to the head of the Great Canyon, the grades are generally very easy, but there are a few short lengths of 1 per 100, and one of 1.33 per 100 for a mile and a half, the latter however can be improved; on seven miles of this portion there will be some rather heavy rock cuttings on the borders of Bluff, Middle and Twist lakes, including a tunnel 1,000 feet in length. Of the remainder, one half will be very light work and the other medium; there are five crossings of the Homathco river, from 75 to 100 feet each in width, the banks of the river are low.

This point is 2,285 feet above sea level, and thence down through the Great Canon the distance is 14 miles, with a uniform grade of 2.10 per 100; on the whole of this the works will be excessively heavy—principally deep cuttings in granite, including one tunnel of 3,400 feet in length, and a great number of short tunnels, amounting in all to fully three miles in length.

From the foot of the Canyon to Waddington harbour, at the head of Bute inlet, the distance is 28 miles. The line follows the west side of the valley with easy grades. On nine miles of this, the work will be rather heavy, as there are a number of rock cuttings, chiefly granite and several short lengths of tunnel, amounting in the aggregate to about 2,000 feet in length. On seven miles the work will be medium and the remainder, 12 miles, very light work.

WADDINGTON HARBOUR TO VANCOUVER ISLAND.

From the head of Bute inlet, the line follows its western shore 50 miles down to the Arran rapids, which separate Stewart island from the mainland.

The whole of this is on the rocky slopes of high mountains, very irregular and broken; sometimes the slopes are easy and covered with timber, often they are steep and rugged bare rock, with granite cliffs several hundred feet in height, close to the water, which is everywhere of great depth. With undulating grades, and curves as sharp as 900 feet radius, the works on this portion will be excessively heavy; there will be a large quantity of rock excavation, chiefly granite, and a great number of tunnels from 100 feet to 3,000 feet in length, amounting in the aggregate to about eight miles, which however could be much reduced by using still sharper curves.

From this point on the mainland to the west shore of the Seymour narrows on Vancouver island, the line crosses by Stewart, Valdes and Maude islands, in a rather circuitous course, to avoid high rocky hills. The distance is about 29 miles, and there are six intervening channels of great depth, through which the tide flows at the rate of four to nine knots an hour. The following table shews the breadth of these channels on the line surveyed, and the probable lengths of bridging required:—

NAME OF CHANNEL.	BREADTH of CHANNEL. FEET.	LENGTH of BRIDGING. FEET.
Arran Rapids...	1,137	1,100
Cardero Channel.................................No. 1.	1,397	1,350
" .... " 2.	1,236	1,140
" .... " 3.	704	640
Middle Channel between Valdes Islands............	1,190	1,100
Seymour Narrows, with rock near centre, covered with 18 feet of water at low tide.	2,575	1,200 1,350

The rock excavation in crossing these islands will be heavy, with a few short tunnels; altogether the works on this section will be of a most formidable character. They are, however, capable of several modifications. *First:—To avoid all the heavy bridging*—The line could be constructed down the shore of Bute inlet, 45 miles to Fawn bay, reducing the length of ferry to Oyster bay, on Vancouver island, to 40 miles.

Second:—Also avoiding all the heavy bridging. The line could be carried from Fawn bay across a pass three miles in length to the Estero basin, thence the ferry to Otter cove, on Vancouver island, by the Frederick arm and Nodales channel, would be reduced to 16 miles of calm water; but probably about half a mile of tunnelling would be required.

Third.—With only one heavy bridge—From Fawn bay the line could be extended down the shore of Bute inlet to the Cardero channel; bridging this, by the Dent islands to Valdes islands; thence across the latter to a bay on Discovery passage opposite Elk bay on Vancouver island; and thus reduce the ferry to three miles in tide water, running two to four knots an hour.

RESULTS OF THE SURVEYS OF 1871 AND 1872.

The surveys and explorations of 1872 have been directed in search of a practicable line for the railway, through the Rocky mountains, by the Yellowhead pass, and thence branching into three lines from their wes ern slope; two terminating at Burrard inlet, on the Strait of Georgi (Pacific coast), and the other at Bute inlet—about 120 miles farther up th strait.

The result is that a very favourable line has been found, clear throug the Rocky mountains, and down the Thompson river to Kamloops, a di tance of 300 miles, with the exception of about 20 miles, from Moose t Cranberry lake, which requires revision; but from that point the tw lines surveyed through the coast chain of mountains in 1871-2 (connec ing at Fort Hope) to Burrard's inlet, have proved very unfavorable.

The line to Bute inlet is more favorable through the coast chain c mountains to Waddington harbour, at the head of the inlet, where tid water is reached, and from which the navigation is good to any harbou in British Columbia. But the surveys shew a possible connection wit Vancouver Island, via Seymour narrows, by railway, the whole of which, o a portion of it—with a ferry—could be constructed whenever circum stances should arise to warrant the outlay. And from Seymour narrow the railway could be taken to any harbour on the east coast of Vancouve island, or to Alberni canal (Barclay sound), on the west coast, at moderat outlay.

It is the connecting of this route with the Yellowhead pass that i the least satisfactory. The starting point is too far down the Thompso river to get a favorable line across to the Chilcotin plains.

If it were possible to get across from the head waters of the north Thompson, by the head of the Clearwater lake, to the Horsefly valley much of the difficulty would be avoided, and the distance considerably shortened; the importance of this may demand further examination.

There is yet another route, which, from information I have gleaned from various sources, gives promise of a practicable line, and which I think is well worth the expense of a survey.

This route will leave the Thompson valley at some point between Clearwater and Kamloops, thence by the valleys of the Bonaparte and Hat rivers to the Fraser river, near Lilloet; the line will then cross the Fraser and follow the shores of Seaton and Anderson lakes, and thence by a series of valleys through the Cascade mountains to Howe's sound on the Strait of Georgia.

On reference to the map it will be seen that this route is very direct from Yellowhead pass to the waters of the Pacific, but its engineering features or its practicability can only be ascertained by the test of actual survey.

CONCLUSION.

It gives me great pleasure to state, that, generally, the several members of the staff have conducted their work with commendable zeal and energy; and some of them have had to contend with difficulties and dangers, coupled with excessive hard labour, that required both nerve and determined resolution to surmount. Several accidents have occurred, but fortunately only one resulting fatally. Once a whole party (W) were surrounded by fire within a small space which they had cleared, and the fire consuming the roots of the surrounding trees, one of the trunks fell across the camp and injured an Indian very severely; at this time they had but a small store of provisions with them and the depot was several miles distant, with the intervening space all on fire, and the bridges they had constructed were burnt down.

One man fell over a high cliff in the Canyon and was so seriously injured that he had to be carried in a litter from camp to camp as the party worked onward, till they reached the open valley and met the pack train.

On several occasions some of those engaged on the surveys have had to swim for their lives in deep lakes and rivers; others have had narrow escapes crossing mountain torrents, in one of which a poor Indian was drowned; the Engineer in charge with another Indian reached the shore much exhausted.

Frequently, the only available passage has been made by falling trees across deep chasms in the rocks, or by drilling holes and inserting bolts to support a slender causeway of timber on the faces of cliffs, washed at their base far beneath by glacial torrents. While mentioning this dangerous work I must pay a just tribute to our Indian attendants, whom I have seen carrying heavy loads over places which looked as if a goat could scarcely find footing on them.

At first we had some vexatious delays through the desultory habits of the coast Indians, but afterwards when we understood better how to manage them, we found them very useful, more especially the tribes of the interior, and I am glad to say that throughout the whole of the surveys and explorations extending over 2,000 miles, among the mountains of British Columbia, in which we met with many different tribes, we have had no difficulty with any of them; and though sometimes a large quantity of stores have been in charge of only one man, several miles away from the engineer's camp, there has never been an article stolen or a threat used.

The explanation of this is simple; they frankly acknowledge that we have treated them with fairness and kindness, and all whom we have employed are anxious to work for us again.

I am Sir,

Your Obedient Servant,

MARCUS SMITH.

APPENDIX F.

Progress Report on the Surveys made in the Eastern Section by
JAMES H. ROWAN, C. E.

OTTAWA, 5th June, 1873.

To
SANDFORD FLEMING, ESQ.,
Engineer in Chief C. P. R.

SIR,—

I have the honour to submit for your information the following repor on the work performed since the date of my last (April, 1872) up to the present time, on that part of the line extending from Mattawa to the Red River.

It may be well, however, before speaking of the proceedings of the past year, briefly to describe the position of affairs at the date of my report above referred to.

At that date the Engineers in charge of seven of the eleven divisions, into which the district was divided, had completed their work and had returned, or were on their way, to Ottawa. Of the remaining four, three were still employed completing their divisions; and in place of the fourth who had left the work, another was sent out.

The division of one of the above, together with that last named, included the tract of country extending from the mouth of the Mattawa river to the great bend of the Montreal.

From this point westward, for about 190 miles, a favourable line was found (which further exploration could no doubt improve) being on the north side of the "height of land," or watershed, between Lake Superior and Hudson's Bay.

This brings us to a point which is about 65 miles, in a direct line, north of Michipicoten, on Lake Superior, and from it wesward to Rat Portage, or the outlet of the "Lake of the Woods," (a distance of about 495 miles), the route followed, in the endeavour to bring the main line to the waters of Lake Superior, although on some portions of a favourable character, was on the whole impracticable.

From Rat Portage to Red River, about 118 miles, was favourable, and can be improved.

The work performed during the past year, to which I am now about to refer, consisted in completing the 150 miles west from Mattawan explorations north of Lake Superior, with a view of carrying the line north of Lake Nepigon, and thence to Rat Portage, thus avoiding the unfavourable tract of country traversed the previous year; and lastly, the exploration for a branch line to connect the main line with the waters of lake Superior.

Of the 150 miles at the eastern end of the district, a portion of the first twenty miles, which lies to the west of and almost parallel with the Ottawa river, was found to be very rugged, but it is believed, from the information obtained, that by taking the line nearer to lake Nipissing and along the "Height of Land," a favourable locatian can be found.

A very favorable line and section was obtained through the valley of the Montreal river, connecting with the work completed last year.

Sufficient information having been obtained, to demonstrate the practicability of constructing the line from its eastern terminus across the "Height of Land," it was not considered necessary to prosecute further the preliminary survey, through the country drained by the Ottawa river and its tributaries

As it was most important, however, to carry through and connect the favourable line found towards the eastern terminus, with the western end of the survey, and to ascertain whether a practicable line could be found north of the rugged country traversed last year, to the north of Lake Superior: a party was sent in from the lake by the Pic river, over the "Height of Land" to the outlet of Long lake, for the purpose of exploring eastward from there to the point north of Michipicoten, above referred to.

A second party started from the northeast side of Lake Nepigon, exploring eastward to Long Lake.

A third party started from the same point westward, exploring round the head of Lake Nepigon, and thence westward about 20 miles.

From this point, a fourth party explored 80 miles further west, where they were met by the party which had completed the survey to Red River the previous year, and had then started eastward from Eagle lake, keeping north of the previous year's work, and thus avoiding the broken country then traversed.

In addition to these five parties engaged in exploring along the main line a sixth party was engaged running a branch line from the waters of Nepigon Bay, Lake Superior, to the main line; and later in the season, a seventh party was sent to run a line from Thunder Bay, Lake Superior, to the main line, in order that the Government might be placed in possession of such information as would enable it to decide on the most eligible point for connecting the main line with the waters of Lake Superior.

This last party returned on the 28th May, bringing the plans and section with them, so far completed as to permit an opinion being formed whether a favorable line can be found or not. While, at the same time, the arrangements for the coming season's work can now be decided on.

From Mattawa to Red River, a continuous line of survey with levels has been carried,—the latter being connected, at Mattawa, with the instrumental survey made some years ago in connection with the "Ottawa Ship Canal," and by this means the elevation of every point, above tide water, along the survey line has been determined.

A list of the principal lake and river crossings, with their height over tide water, is appended to this report.

The result of this instrumental survey places beyond a doubt, the practicability of constructing a line of railway from the vicinity of Lake Nipissing to Red River, on which neither the amount of excavation and embankment,the bridging,the grades,or the curves will be exceptionally heavy.

On that portion of the line between Red River and Lake Superior, including the branch, I believe it will be possible so to construct the line that no grade exceeding 52.80 feet per mile will be required, and that grades of this inclination will be neither numerous or of any great length.

On that part of the main line between the Nepigon branch and th Eastern terminus, the present approximate section shows a few points wher grade of 70 feet to the mile are introduced. I believe, however, that furthe exploration will enable these difficulties to be avoided and, that throughou the whole district no grade exceeding 52.80 feet per mile will be required and of this a proportionately small amount.

It may be expected that a considerable part of the excavation fro cuttings on the line will be rock; the embankments will be made in exces of the cuttings, and can be formed from side excavations or borrowing pit where material may more easily be obtained.

Attention to the particular work on which they were engaged, le little time for other explorations at the disposal of the various parties; i may be stated, however, that the country traversed gave indications, a many points, of the existence of iron, copper, gypsum, also of the mor precious metals; and I think it is not improbable that coal or other minera fuel may be found, if not immediately on the line of railway, prabably a no great distance from it in the country to the north. Sufficient timber fo railway purposes can also be procured, and, although a considerable portio of the land may be unfit for agricultural purposes, there are tracts of fai quality to be met with at various points along the line.

The experience gained from the previous year's work, enabled the Commissariat Department to overcome more easily many of the difficultie which had to be contended with, still the work of keeping the variou parties supplied with necessaries, every pound of which had to be carried in many places for long distances, on men's backs, is one of the greates difficulties connected with carrying on the survey, requiring a large staf of men and involving great expense.

Having now a much better knowledge of the country through which the line will pass than in previous years, advantage can be taken o streams and lakes, to transport supplies, the existence of which was then unknown. This will, to some extent, lighten the labour of taking them in when either the work of further exploration or permanent location is undertaken.

A subject must now be referred to which is of a very painful nature namely, the loss of life in connection with this work during the past year And, although a detailed report of two accidents has already been submitted, I shall here repeat the facts connected with them, and at the sam time report on two others not previously referred to.

The first accident this year occurred as follows: A party consistin of Messrs. A. Hamilton, in charge; E. J. C. Abbott, transitman; E Haycock, leveller; G. Knaut, chainman; with a number of axe and pack men—of whom G. Rochette was one—had completed the survey of a portion of the line through the valley of the Montreal river, and, on thei way back to Ottawa, encamped at its mouth. Here the men were left, i charge of Mr. Haycock, while Messrs. Hamilton and Abbott went up Lak Temiscamang, to the Hudson's Day Post, in a small canoe, for the purpos of settling accounts, obtaining letters, and bringing down Messrs. Knau and Rochette, who were laid up with scurvy at the Rev. Mr. Pian's.

On the 20th May, 1872, having arranged their business at the Hudson's Bay Co. Post, Messrs. Hamilton and Abbott started from the Revd. Mr. Pian's, with Messrs. Knaut and Rochette, in the small canoe, declining the use of a larger one kindly offered by the above named gentleman. This was the last ever seen or heard of them.

On the 22nd May, a man named McVeigh arrived at the camp from the Post, and surprised at not finding Mr. Hamilton and party there, informed Mr. Haycock that they had left the Post two days before.

This information causing great anxiety to be felt on their account, a search for them was commenced immediately. The following day their canoe was found bottom up, with some books, papers, &c., tied in it, about five miles below the camp, or seventeen miles from the Post. No trace of the missing men could be found, although by your orders, the search for them was continued until the end of June.

The lake was rough the morning they left the Revd. Mr. Pian's; Messrs Hamilton and Abbot were, however, good canoe men; is is therefore supposed that the sick men's limbs becoming cramped from sitting in the bottom of the canoe, they endeavoured to change their position, thus overturning the canoe; and, the water being extremely cold, they were unable to swim any distance, consequently were drowned.

The second accident this year occurred to some of the party sent out in charge of W. Murdoch, Esq., C. E, to make an exploration from Thunder Bay to the main line of survey.

They left Collingwood the 15th November last, on board the steamer "Cumberland" finding, after proceeding as far as Tober Moray Bay, that the steamer would not take them through to Thunder Bay, in consequence of the crew refusing to go on, they took passage back to Collingwood on the steamer "Mary Ward."

On the 26th November, during a very severe snow-storm, the "Mary Ward" was wrecked on a shoal, a few miles to the west of Collingwood, while endeavouring to make that port.

After having been for some hours on the shoal, in an effort to reach the mainland, eight persons were drowned; the remainder of the crew and passengers succeeded in reaching it.

Of the eight men lost, three belonged to the surveying party, namely: F. Chadwick, of Simcoe, Rodman; Wm. Caldwell, of Toronto; and C. D. Taylor, of Orilla, Axemen.

One more accident occurred on the 13th November last, on one of the smaller lakes, west of Nepigon, by which Michael Clancy lost his life, the accident is thus described to me by the Engineer in charge of the party:

"In the beginning of that month (November) I found it necessary to "send nearly all the party back about 25 miles, for the purpose of packing "up the provisions. The deceased (a foreman) in his anxiety to push the "work, left the line where it runs close to the edge of a lake and took to "the latter, which was then frozen over. He sent back three Indians "who were with him three miles for another load, and took their loads, "weighing 400 lbs., placing them on two poles and started across the lake. "The Indians on their return could not find Clancy, who had promised to "return immediately. This lead to a search, and, after a short time, they

" found a hole where he had broken through, and his cap floating on t " water.

" They at once gave the alarm, but three hours elapsed before t " arrival of assistance; at the end of that time the unfortunate man's broth " came, a raft was made, and the remainder of the day was spent in searc " ing for the body. It was not until the third day after, that the bo " was found."

This last case closes the list of casualties, which it is my painful du to submit to you; and I can but express the hope that something will done by the government to aid the families of those who have lost the lives on this service.

I cannot close my report without expressing satisfaction at t manner in which the staff generally have performed the duties entrust to them. Independent of the risks to life, which are considerable, the har ships endured, especially by those whose lot it was to be out all winter, ha been very great; these have been cheerfully borne, and the work in t field pushed through in a satisfactory manner.

I remain,

Sir,

Your obedient servant,

JAMES H. ROWAN,

Engineer in charge of Eastern Distric

CANADIAN PACIFIC RAILWAY.

Elevations above the Sea of the principal lakes and rivers on the line of the Canadian Pacific Railway Survey, between Mattawa and Red River.

NAMES OF LAKES AND RIVERS.	AUTHORITY.	Elevations.
Crossing of Mattawa River	Ottawa Ship Canal Survey.	489.00
Lake Nipissingue	" " "	634.00
Montreal river, (5 miles from mouth)	Canadian Pacific Ry. Surv.	711.00
" " (Great Bend)	" " "	1050.00
Moose river, (East Branch)	" " "	1034.00
" " (Main Branch)	" " "	887.00
Lake Kayburogaganni	" " "	1016.00
Head waters of White riv.	" " "	1081.00
" " Black riv	" " "	1013.00
Pic river	" " "	616.00
White Fishlake (supposed)	" " "	....
Head waters, Little Pic riv.	" " "	970.00
Long lake	" " "	1028.00
Jack Fish river	" " "	647.00
Nipegon river (L. Sup)	" " "	598.00
Black Sturgeon river	" " "	633.00
Black Sturgeon lake	" " "	795.00
Nipegon lake	" " "	852.00
Crossing of Opahwonga lake	" " "	947.00
Sturgeon lake	" " "	1327.00
Eagle Lake	" " "	1173.00
Lake of the Woods (Rat Portage)	" " "	1042.00
Crossing of Little Long lake	" " "	1028.00
" Red River	" " "	714.00

APPENDIX G.

Detail Report of Operations in the Rocky Mountains by the Party under the charge of WALTER MOBERLY, *Esq., during the year* 1872.

ATHABASCA DEPOT, JASPER VALLEY,
January 13th, 1873.

SANDFORD FLEMING, Esq.,
Engineer-in-Chief,
Canadian Pacific Railway,
Ottawa.

SIR,—The different instructions from you, conveyed to me in March 1872, respecting the completion of the surveys between Great Shuswap Lake and the vicinity of Fort Edmonton, on the North Saskatchewan river, *via* the Howse and Eagle Passes, induced me to make various preparations to ensure their completion before the close of the past season, the principal details of which are given in another report forwarded to you.

In the early part of April I, however, received further instructions informing me the Dominion Government had decided to adopt "Yellow Head Pass" as the one through which the proposed Canadian Pacific Railway should enter British Columbia; that all efforts were to be concentrated to complete the surveys of that line, and that I was to convey my parties and supplies from the Howse Pass route to the Yellow Head Pass by way of the Athabasca Pass.

This was an undertaking of much difficulty as the waters of the Columbia river, for about one hundred miles above and nearly the same distance below the Boat Encampment, are obstructed for many miles in different places with very bad and dangerous rapids, riffles, and canyons, which render it unnavigable for loaded boats, in places, going down stream, and during high water, quite impassable for them, throughout, proceeding up stream. The banks of this portion of the river are covered with thick forests in which the trees are generally of a large growth, the underbrush dense and from the sudden and violent gusts of wind, that sweep down the adjacent mountains at times, the ground is much obstructed by fallen timber.

On receipt of your final instructions, and after consultation with His Honor the Lieutenant Governor and Mr. John Trutch, District Engineer, who had received instructions to move his parties over to the valley of the North Thomson river, it was decided:

1. That I should instruct party T to return from the "Eddy" on the Columbia river to Kamloops, where they would find the necessary pack animals and supplies ready to enable them to proceed to the neighborhood of Cranberry Lake and continue the survey in the direction of the Yellow Head Pass, from the easterly limit of the survey made by Mr. Roderic McLennan's Q party.

2. That out of the party I had engaged in Victoria, with the intention of employing it in the survey of a line from the "Summit" of Howse Pass, easterly down the valley of the North Saskatchewan river, I should form a party (known as the North Thompson Trail Party) to proceed to Kamloops and thence up the North Thompson river, through the Yellow Head Pass, and thence easterly constructing a good trail for pack animals throughout to enable supplies, &c., to be forwarded for Mr. John Trutch's and my party T, and which would at the same time open a route through to the easterly side of the Rocky Mountains.

3. That I should proceed to the Howse Pass and get party S, together with all supplies at that place or in route thereto through by way of the Athabasca Pass to the Yellow Head Pass, coming into the latter at the former site of the old Rocky Mountain Fort-Henry House.

4. That Mr. John Trutch should look after the North Thompson Trail and T parties during the time that might elapse before my arrival in the Yellow Head Pass.

After dispatching a messenger instructing party T to return to Kamloops, a telegram to Walla Walla to be forwarded to Colville in order to prevent the steamer "49" going up the Columbia river to the "Eddy" with the supplies intended for party T during the summer, and also a messenger to party S, instructing the engineer in charge to abandon the survey then in progress along the Columbia river, I formed and equipped the North Thompson Trail party and sent it to Kamloops, placing Mr. Wm. C. McCord in charge, and then started *via* Portland, Walla Walla, and Colville for Howse Pass.

Having formed the determination before I left Victoria to complete the survey at all events through the Rocky Mountains before the close of the year, I took every possible precaution to ensure its accomplishment, but many obstructions, delays, difficulties and disappointments awaited me which it was impossible to foresee; I am, however, now able to inform you that my original plan is fully carried out and that the survey through the Rocky Mountains was completed on the second of January 1873, to Fiddle river, which falls into the Athabasca river at the head of Lac à Brulé, and which I consider may fairly be called the eastern termination of the mountain district.

Foreseeing also that it would be impossible to complete the survey to the neighborhood of Fort Edmonton, I took such steps as would place me in a position to resume the survey at the earliest possible moment the following year by having a complete survey party together with a small trail party and all the necessary supplies on hand near the easterly end of last season's work, sufficient to complete the survey of the line in this district and the opening of the necessary pack trail along or near it for the transportation of the supplies, &c. The above course will shew a heavy outlay against my district for the past season's work which at first sight and without properly understanding the whole matter would appear unreasonable; I will, therefore, explain it a little more in detail:

Had I only provided the supplies, &c., for the past season, I should have been compelled immediately on the arrival of party S, in October last, in the Yellow Head Pass, to have returned to Kamloops with all hands, left the survey east of the height of land in the Yellow Head Pass untouched, and on resumption of work next season to have again employed large pack trains for the transportation of supplies, &c., from Kamloops to the above point. I should have lost a portion of the month of October and the months of November and December, which I utilized in pushing forward the survey and trail; I should have lost not less and most probably more than two and a half months expenses of party in going down and returning from Kamloops, which would be much heavier than the time the party will now lose in winter quarters, and neither parties from the east nor west could possibly have resumed the survey in the mountains before the 1st of June, and most likely not so soon, as high water would have set in and retarded the progress of pack trains, whereas now I propose to resume it and the construction of the trail by the first of March. You will therefore observe in the coure taken by me the time actually gained in accomplishing the completion of the work will be upwards of five months, and total outlay for the *two seasons work most materially lessened.*

From Portland I went to Wallula by the Oregon Steam Navigation Company's steamers and railroad, and thence, *via* Walla Walla, to Colville, by waggon, over a road which nature has almost entirely provided.

From Colville I proceeded nearly all the way to the Boat Landing on the Columbia River by the trail I followed last year.

On my way up I made various changes in the disposition of the supplies, pack trains, &c., rendered necessary by the latest instructions to abandon work on the Howse and resume it on the Yellow Head Pass route.

I arrived at the Columbia River Depot on the 15th and the camp of Party S on the 16th June.

Immediately after my arrival, I set the boats at work freighting the supplies from the Boat Landing to the Slate Canyon—a distance of about eighty miles; had a rough trail opened to get unloaded pack animals down from the Boat Landing to the same point, as the low flats bordering the Columbia River, over which I took my animals the previous year withou a trail, were overflooded and impassible, and also had the opening of the trail along the valley of the Columbia River, from the Slate Canyon to the Boat Encampment, pushed forward as fast as possible.

Having been compelled on my arrival at the Slate Canyon to discharge several of the men for various causes, and as the Indians that worked for me the year before in the boats and canoes were away, I could not get the trail opened and the goods boated as fast as I had expected, as other hands were not to be got without sending several hundred miles for them. (This is one of the greatest difficulties in hurrying work in this portion of the country, for if you have a worthless or indifferent worker you must either put up with him or go without any one in his place.) Trail making along the Columbia River also required a great deal of work.

Owing to the dangerous navigation on the Columbia River and care required in picking out a trail to avoid all unnecessary work possible, as well as to have the boats and animals employed to the best advantage, I was obliged to be ahead both on land and water, and found it absolutely necessary to keep constantly in the vicinity of the trail party, the boats and pack trains, in order to avoid any delay in their general forward movement; and, as I was anxious to hear how my parties were getting on between Tete Jaune Cache and Jasper House, and also to forward them instructions, I sent a former member of the staft of Party S, with two Indians whom I managed to get after much trouble, with letters for those parties, and one for yourself, as I expected you would be in the Yellow Head Pass about the end of August. They started on the 19th of July. To my extreme vexation the member of the staff returned in two days, having concluded the trip was too heavy an undertaking for him to accomplish; the Indians, however, went on with the letters.. They did not return until August 14th, having proceeded as far as the west end of Moose Lake without seeing anything of the parties. The information gained from them, and which I afterwards found to be very correct, indeed, was that Party T was not nearly so far forward with the survey as I expected; that they were certain there had not been any person through from the Athabasca River to Moose Lake by the Yellow Head Pass this season, with the exception of an Indian with an unshod horse; that it was difficult to distinguish the old trails in many places; that we would find much fallen timber, particularly between the Committee's Punch Bowl and Henry House; and they did not think it possible to get Party S and the supplies over the Athabasca Pass before the snow fell.

All this information made me extremely anxious, so I decided togo over to the Tete Jaune Cache, and having got a large quantity of the supplies down by the boats to the foot of Kinbaskit Lake – the trail also opened to within a mile of it—and as I could, in a few days, discharge the boats, there being no navigable water below the above point we could utilize, I started on the 27th August over the mountains from the foot of the lake, in as direct a course as possible for Yellow Head Lake, leaving orders with Mr. Green to open the trail to the Boat Encampment, and thence up the Athabasca Pass, with the utmost despatch, and for Mr. Hall to keep all the supplies close up to the trail party. I also instructed Mr. Hall to send about sixty pack animals down to Kamloops as soon as the supplies were all to the lower end of Kinbaskit Lake. The animals left on the 3rd of September, and should have reached Kamloops about the beginning of November.

I reached the Yellow Head Pass on the 6th of September. This mountain trip was rather arduous, as we were obliged to cross the summits of five distinct ranges of mountains varying from six to eight thousand feet in height, crossing the main ridge of the Rocky Mountains twice, and the mountain sides were steep, rugged, and in most cases covered with much fallen timber and underbrush, as well as with thick forests. My object in taking this course was to save as much time as possible by cutting off the roundabout way by the valley of the Columbia river to the Boat Encampment, thence by the Athabasca Pass to Henry House, and thence by the Caledonia and Fraser valleys. The Indians I had sent over before were fourteen days travelling time in making the trip from Kinbaskit lake to the same point where I came into the Yellow Head Pass (foot of Yellow Head Lake); they made the cut off from the northerly end of Kinbaskit lake to the Athabasca Pass at the foot of Mount Hooker, and thence followed the Athabasca and Yellow Head Passes. It will be seen the travelling time it took me to reach the same point was nine and a half days, as I arrived there at 1 p.m. on the 6th September.

On ascending to the height of land in a wide grassy depression, at a height of six thousand five hundred feet above the sea level, that afforded us a passage over the last range of mountains crossed on this trip, and which form the northerly boundary of a pass immediately north of Mount Brown, connecting the valleys of the Whirlpool and (probably) Canoe rivers, I came on several small ponds which form the source of a stream that flows in a course N. 50° W. mag. (variations of compass about 26° E), some thirty miles, and rapidly increases in volume, being fed by several considerable tributary mountain streams, until they form a fair sized river, which after flowing with a gentle current over a gravelly bed for nearly two-thirds of its length through a fine valley with grassy slopes and picturesque groves of fir trees, becomes confined in canyons and gorges through which it dashes and roars a turbulent and *apparently* small stream until it forms a junction with the stream flowing out of Yellow Head lake, a short distance below it. *The source of the above described stream is the true source of the Fraser river*, and the scenery around it is both beautiful and magnificent, and well worthy of encircling the origin of that grand river.

The small stream or rather creek that falls into the head of Yellow Head Lake, and which is generally called the source of the Fraser, has a length of only some four or five miles and is of inconsiderable size.

On reaching the bottom of the valley which is the continuation of the Yellow Head Pass, we forded the river and were much gratified by coming on a newly cut pack trail which we followed easterly about a mile to the foot of Yellow Head Lake, where we found Mr. McCord's trail party. From him I learnt the T party were in the neighborhood of the west end of Moose lake with the survey, so I at once communicated with the engineer in charge who came up to see me on the 8th September. The engineer in charge of party T now informed me his party had been detained on their way up, having lost various necessary supplies in the canyons of the Thompson river and also from other causes.

I learnt you had not as yet passed through *en route* to the Pacific Coast.

Having now ascertained the position of my two parties westward of the Yellow Head Pass, I concluded to take four of the trail party's horses, cut my way through and explore that pass and thence down the Caledonia and Jasper valleys to Jasper House, before returning by the Athabasca Pass to party S on the Columbia river, as the above portion of the proposed line of railway had not previously been visited by any of the railway parties: Mr. Roderic McLennan having returned to Kamloops on the 21st October, 1872, on reaching the easterly end of Moose Lake, I also had hopes of ascertaining some information as to your movements. Having fallen on your track near the head of Jasper Lake, I overtook you at the mouth of the Miette, on 14th September, and returned with your party to camp T, one mile above the west end of Moose Lake and as your instructions then coincided with my views respecting the furtherance of the survey and trail easterly, I did not enter into full details respecting them. On leaving you at the foot of Moose Lake, on the 17th September, I conveyed to the engineer in charge of party T your instructions and strongly urged upon him the necessity of making every effort to make up for the time the party had lost, and also requested him to explain fully to you the causes that occasioned the delays his party had sustained.

On the 18th September, I started from the head of Moose Lake on my return to the Columbia river, *via* the Athabasca Pass, taking four horses; it took me two days to make about twenty miles from the Henry House, as fallen timber much obstructed our progress. On the evening of the 24th September, being the fourth day from Henry House, I camped one mile south of the Committee's Punch Bowl—here the snow was four inches in depth and everything had a wintry appearance. I found a great deal of work would be required to make a passable trail for pack animals from the top of the mountain to Henry House, owing to the swampy nature of the ground for some fifteen miles across the height of land, as well as from the quantity of fallen timber on the more northerly portions of it. Everything looked most unfavorable for the forwarding of the party and supplies from the Columbia to Henry House. I went on and early in the morning of the third day from the Committee's Punch Bowl, having waded almost endless fords and dragged and jumped the horses through and over thickwoods, underbrush, rocks and fallen timber, reached the camp of party S which was on the south bank of Wood or Portage river about two miles above the Boat Encampment, it having been exactly a month since I left the party at Kinbaskit lake. I told the party it was my determination to push forward with the supplies and animals across the Rocky Mountains to the Athabasca river, where I had instructed Mr. McCord to build a depot, and also to finish the survey through that range to its easterly base before closing work for the season; I gave those afraid of undertaking the trip the opportunity of leaving, which only a few availed themselves of, and the rest of the party went to work with a most praiseworthy will, working both week days and Sundays, through rain, snow and cold, without knocking off for an hour until the trail was opened and the survey party to the Athabasca depot.

On the evening of the 1st October the trail was passable, though not finished, as a good deal of corduroying was needed, to the foot of Mount Hooker, a distance of about twenty miles from the Columbia, and nearly all the pack animals on the way between the Boat Encampment and the above point. On the 2nd I started back for party T, from the foot of the mountain, taking Messrs. Green and Hall a part of the way up Mount Hooker to show them where to open the trail and get the supplies to. My endeavor now was to get the supplies all to the height of land, the ascent to which in one place is at an angle of elevation of about seventy-five degrees, so that should I not be enabled to pack them all the way to the Athabasca depot before stopped by the snow, they would be over the height of land, and there would be a descending grade along the Whirlpool and Athabasca rivers over which to convey them in dog sleighs.

I arrived at the site chosen by Mr. McCord for the depot on the evening of the 5th October, and found he had one storehouse well advanced; this depot, known as the "Athabasca depot," is situated on the left bank of the Athabasca river, about four miles below the mouth of Miette's river, and some twenty-one or twenty two miles by trail above Jaspar House, and immediately below your camp No. 48; the site was selected principally on account of the convenience of timber for building purposes and firewood, and also from the shelter afforded by a neighboring high "bench" from the northerly and southerly winds which blow with great force almost continually in the Jasper valley.

Mr. McCord informed me he heard the survey party T was several days previous to my arrival within one and a half miles of the "Divide" in the Yellow Head Pass, and that he had already sent his pack train to bring the surplus stores of the party to this depot, as the engineer in charge had informed him he could not spare the train from his party for that purpose. The first thing in the morning of the 6th I started for the "divide," and on my way up met a messenger bringing me letters from you and also one from the engineer in charge of party T, informing me he had started for Victoria on the 3rd, taking his entire party and pack animals. I also learnt one of Mr. Trutch's pack trains, kindly sent by that gentleman, was on the way up with a load of supplies for my parties.

The weather had been very bad since I left the foot of Mount Hooker, and I passed the Committee's Punch Bowl during a heavy snow storm, at which time there was six inches of snow on the ground, the rivers and creeks became greatly swollen, the trails cut up and muddy, and the grass all killed and frozen. I afterwards learnt that many of the pack animals at this time were unable to cross the different fords on Portage river, which greatly retarded the progress of some of the supplies.

I now returned to the Athabasca depot and sent Mr. McCord out with a few men to open the trail to meet party S, and then discharged all other here whom I sent down to Kamloops with Mr. Trutch's train, which afte remaining over one day returned. I wrote to you by that opportunity.

It being now quite apparent to me it would be almost impossible t get all the supplies down from the Whirlpool river, and that I should als have to take great risks with the pack animals to get them well forward, made a hurried trip to Jasper House to see Mr. Logan, the gentlaman i charge of that post of the Hudson's Bay Company, about getting dog sleigh and moccassins. On my return I followed Mr. McCord's party, and ove took them twelve miles out at the "Prairie des Vaches." Next day I wen on and met Mr. Green and party S about twenty miles above the Henr House; the following day, October 19th, the trail was completed, and returned with Mr. Green to this depot to have everything in readiness t move the survey party up to the divide in the Yellow Head Pass. On th 20th the S and McCord's trail parties reached the depot, the men wer allowed a day to wash clothes and recruit.

COMMENCEMENT OF SURVEY.

I took the party up to the "divide" and commenced the survey on th 24th October from a point near the bank of the stream flowing westerl from the "divide" into Yellow Head Lake, where we continued the surve from that made by party T, and camped on the same ground they had occ pied exactly three weeks before, the night previous to starting on their return to Victoria.

With the animals now all very much worn out and weakened, and the grass, with the exception of that in the valley of the Athabasca, unnutritious, and in hourly expectation of snow storms, I concluded it to be the safer plan to have the work done at the divide first and get as close to the Athabasca river where we could get feed for our horses should a heavy fall of snow take place ; by following this course I would leave no portion of the line unsurveyed between the Fraser and Athabasca rivers. With the exception of three days, occupied in a trip to the depot, I remained with the survey party until the survey was completed to the lower end of all the rocky side hills below the " Horse Rapid," and on the 9th November returned to the depot to ascertain how the pack trains were getting on,—the first heavy snow fell the night before my return and at our camp between dark and daylight attained a depth of ten inches and covered up all the grass—as we had already got well down from the divide and that day moved camp some three miles nearer to the Athabasca river, towards which we were also working, it did not obstruct the survey much as it got much lighter as we approached that river, and when I reached the depot the same evening, found only three or four inches of snow there.

I here received a letter from Mr. Hall, informing me he had very severe weather at the Committee's Punch Bowl, and the cold, snow and want of feed for the animals had so weakened them that many were unfit to pack and would undoubtedly perish if kept up there any longer; I therefore wrote him to pick out the strongest and work them in getting the supplies down to a point about thirty-five miles from this depot and below the bad portion of the trail and to send the weak ones back to winter quarters, on the Upper Columbia, where we wintered our animals last year, with instructions for them to proceed to Kamloops as soon as possible in the spring. I, at the same time, told him to discharge and send below every packer he could possibly do without, and thus again materially reduced our numbers.

I now went down and explored the opposite or right bank (I had previously examined the left bank) of the Athabasca river and Jasper Lake to the lower end of the rocky point that projects from the Roche-a-Miette about two miles below Jasper lake, and on this trip took loaded pack horses over the ice along portions of the Athabasca river and across Jasper Lake.

Although the weather was excessively cold and the days short the survey made very satisfactory progress, and on the 26th of November it reached the Athabasca depot—many of the party during the coldest weather were obliged to sit up all night making fires to keep warm.

On the 21st November, I met Mr. Hall, and he reported that in consequence of the continual snow storms and intense cold that had covered up and killed the grass in the Whirlpool Valley, the animals could not stand working up there any longer, this caused me to instruct him to build a depot on that river, at the point (35 miles from the Athabasca depot) to which I had previously told him to get the supplies to from the Committee's Punch Bowl, and to store all the supplies he could not get down by the pack animals on their return, and also to get all the supplies then below that point down here and bring the animals into the Jasper Valley—excepting 5,000 lbs of flour cached about eight miles south of the Committee's Punch Bowl, all the supplies were at this time at the point where I directed Mr. Hall to build a depot on Whirlpool River, at the Prairie des Vaches or at the Athabasca Depot. The pack animals all got down below Henry House finally on the 3rd December.

My object before stopping work for the season being, as before remarked, to complete the several works through the Rocky Mountains and have a quantity of supplies forwarded to the easterly termination of the trail to enable us to prosecute the works easterly with vigor as soon as we can get into the field, I directed Mr. Hall to forward supplies sufficient for three months for the survey party, and for five months for the trail party, in addition to those required by the parties during the time they might yet be occupied in completing the work to Fiddle River, which I consider the easterly termination of the mountain work.

The trail was open, and the first train load of supplies reached the Fiddle River on the 28th December. On the 30th, Mr. McCord commenced to build the depot there, and as I had previously picked out the places for the animals to winter at, I gave Mr. McCord his final instructions and returned to the Athabasca Depot on the 31st; Mr. Green having completed the survey to the Fiddle River, on the 2nd January, returned with the survey party and reached the depot on the 5th; the pack animals for the balance of the supplies to be forwarded returned and again left with their last loads for Fiddle River on the 8th, and were turned out for the winter on the 23rd of January.

It was with much reluctance that I felt obliged to discontinue the work, but I saw if I kept pushing on, I should lose the animals and therefore be much delayed at the opening of next season. I also wished to prepare the plans, reports, &c., &c., for transmission to you, which it was out of the question to do in camp.

I propose to leave the old Hudson Bay Company's trail at Fiddle River and get out of the Athabasca Valley at the first practicable point, and thence continue the survey along the most favorable line I can find for some point between the mouth of Brazeau river and Fort Edmonton, over the high elevated plateau, averaging in altitude three thousand feet above the sea level and which extends easterly from the eastern base of the Rocky Mountains. I have as yet only explored some ten or twelve miles below Fiddle River, and have found a route that will avoid those most objectionable sand ridges on the south easterly shore of Lac à Brulé.

The Fiddle River Depot will be our starting point and base of supplies for next season's work (easterly); it is within three miles of the winter range chosen for most of the animals, which is at the south westerly end of Lac à Brulé where there is a salt spring, good feed and shelter. The range for the remainder of the animals is on the left bank of the Athabasca river, about four miles below the mouth of Snare river and ten from this depot.

Our explorations last season having been in the heart of the Rocky

Mountains, it cannot be expected we should have met with any land adapted for settlement.

With the exception of a few spots of very limited extent, the valley of the Columbia river, from the Howse Pass to the Boat Encampment, is unfit for settlement, and is covered with a dense and heavy growth of timber, of which white spruce, Douglas fir, cedar, white pine and birch are the predominating species. Grass is scarce and poor in this portion of the valley; the points where it was found in any quantity were in the neighbourhood of Placid river, at the head of Kinbaskit lake, and at the Boat Encampment.

Around the Boat Encampment there is a tract of flat land, where the soil is rich, the grass plentiful and the timber good.

Through the valley of Portage or Wood river, from the Boat Encampment to the foot of Mount Hooker, a distance of about twenty miles, there is not any land fit for settlement, and the timber is generally of a poorer growth than that in the valley of the Columbia. The grass in this valley is not over plentiful.

From the foot of Mount Hooker over the main ridge of the Rocky Mountains at the Committee's Punch Bowl, which is 6,025 feet above the sea, and thence down the valleys of the Whirlpool and Athabasca rivers to Henry House, a distance of fifty-five or sixty miles, our route passed over rocky and stoney ridges and flats utterly unfit for settlement, generally covered with a growth of small sized spruce and black pine, where it has not been blown down or burnt off, well watered, and in the summer season grass is good and plentiful. Neither cedar, white pine nor Douglas fir have as yet been met with on the easterly slope.

The land in the Yellow Head Pass and the Caledonia Valley is worthless, the grass generally poor, and the timber small sized spruce and black pine.

In the Jasper valley the land may afford a few spots of small extent where some hardy descriptions of vegetables might be cultivated, provided night frosts should not kill them: there is a limited range of excellent grazing ground, and the timber, which is almost entirely white spruce and black pine, rarely exceeds a foot in diameter.

That portion of the valley extending from Jasper House to Fiddle River is very similar in its general features, but more thickly timbered.

The strong, and, since our arrival, almost incessant gales of wind, carrying clouds of dust that blow in the valley, are found very unpleasant.

North of the Boat Encampment, we saw many cariboo and grizzly bears and killed several of the former. In the Jasper valley, the mountain or big horn sheep appears to be plentiful, and we have succeeded in killing a good number, the meat of which, to us, appears excellent. Hares and prairie chicken are numerous below the mouth of Snare river.

With the exception of the Selkirk range of mountains, which is bounded by the "Big Bend" of the Columbia river, and terminates or "runs out" at the Boat Encampment, the other ranges of mountains crossed or passed through either in the Athabasca pass, the Yellow Head pass or the Caledonia, Jasper and Athabasca valleys do not appear, so far as I could judge from very hurried examinations, to contain any of the preciou metals.

The volominous meteorological registers, since November 8th, 187 which have been kept continuously by Mr. R M. Rylatt, storekeeper i this district, with most praiseworthy care and diligence, which I als forward, will give a good deal of information about the climate in th Rocky Mountains, at the different places on the dates when the observatior were taken. I do not think there will be the slightest difficulty or troubl experienced from drifting snow, and from snow slides and avalanch none.

Considering the enormous distances through a most rugged countr that the party, supplies and animals, the past two seasons, have made the way and been transported, the dangerous navigation of the McGillivra branch of the Columbia river and the very severe weather endured bot seasons in the early part of the winters, it is a matter of great congratul tion that we have not sustained any loss of life nor had any accidents, th not a single pound of the supplies has been lost in transit, (coming by wa of the Columbia), and out of nearly two hundred and fifty pack anima employed, only seven have died in all, which is not at all surprising a nearly all the pack animals on this route travelled back and forth la season about two thousand and seven hundred miles, and almost invariabl averrged loads of three hundred pounds each, except when crossing th divide of the Rocky Mountains, when I gave orders to have all the load lightened as the travelling was excessively bad, the ascent of the mountai very steep indeed, and the "feed," which is good and plentiful in th summer, was in October, November and the early part of December kille by the frost and most of it covered with snow and ice.

The pack trail originally opened in 1871, from Kamloops to th neighborhood of Albreda Lake, by Mr. R. McLennan, was much improve and a new one from thence to Lac à Brulé was opened through the Yello Head Pass by the trail party under Mr. McCord.

It is my intention to resume exploration, trail making and survey ea of Fiddle river as soon after the plans and reports, &c., are forwarded you as the weather will permit.

The accounts, list of supplies on hand, animals now here and elsewher number and rate of pay of men at present employed, &c., &c., whic accompany this report, will show you in detail the position of the Distric with the exception of the T party's accounts and number of pack animal which I have not got.

On the evening of the 7th January seven dog sleighs arrived, kindl sent up by Mr. Hardisty, the gentleman in charge of Fort Edmonton, assist in getting our supplies down from the depot on Whirlpool rive These are the sleighs I had previously requested Mr. Logan to send up possible, as I was afraid when the spring opens the water woul rise and prevent pack animals travelling portions of the trail ov the shingle flats along the Whirlpool river, which are overflooded high water.

The dogs, after a day's rest, went up for a load, and reached here wit it on the 12th, and are now bringing all the rest of the supplies down quickly as possible. This will greatly facilitate our movements on the opening of next season.

The methods adopted in dealing with the Indians and half-breeds, belonging to the different tribes met with or employed at various times during the two seasons the party has been in the interior, have resulted most satisfactorily. Not a single quarrel has arisen, not a single article has been stolen, and without exception the most friendly feeling is now existing. The Indians have rendered us much and most valuable assistance.

Having now completed a season's work, extending over a period of upwards of ten months with most of the party now here, during a portion of which time the thermometer ranged from twenty to thirty degrees below zero, and the continual gales of wind in the Jasper and Athabasca valleys were very piercing, in which the members of the party have encountered no ordinary hardships, and during the whole of which time they have scarcely lost a single day's work. I have much pleasure in stating that they have severally performed in an energetic and orderly manner their various duties, and thus enabled me to bring the work of the season to a satisfactory termination.

I have the honor to be,

Sir,

Your obedient servant,

WALTER MOBERLY,

District Engineer, C. P. R.

APPENDIX H.

Detail Report on the Surveys in British Columbia for the year 1873, *by* MARCUS SMITH, C. E.

OTTAWA, *January* 1st, 1874.

SANDFORD FLEMING, ESQ.,
Chief Engineer C. P. Railway.

SIR,—

In my report of the results of the surveys of 1871 and 1872, on that portion of the Canadian Pacific Railway under my charge, it is stated that a favorable line had been found from the summit of the Yellow Head Pass down the eastern slope of the Rocky Mountains to a point in the valley of the Athabasca near to Lac à Brulé; a distance of 49 miles, to which point the surveys had then been carried.

Also, that from the summit of the Yellow Head Pass a line had been surveyed westward, by the head waters of the Fraser to Tête Jaune Cache, thence southerly across the low water sheds by Cranberry and Albreda Lakes to the valley of the North Thompson, following down the same to its junction with that of the Clearwater.

That from and below this point, three distinct routes, with deviations, had been surveyed to the waters of the Pacific; two of these terminating at Burrard Inlet, near the mouth of the Fraser River, in the Strait of Georgia; the other touching Pacific waters at the head of Bute Inlet, but continued down the western shore of the same, and across several small islands and narrow channels to Menzie's Bay on Vancouver Island.

That portion of the line from Yellow Head Pass to Clearwater, 180 miles, which is common to all the other routes surveyed to the Pacific Coast, was considered to be generally satisfactory with the exception of about 22 miles between Moose and Cranberry Lakes, which required revision.

From the several routes surveyed between Clearwater junction and the Pacific Coast, a line to either Burrard or Bute Inlet could be selected that might be considered practicable for railway construction; but on some portions of either line the works would be so very heavy that, with the view of avoiding or reducing those, further surveys were deemed necessary, and it was therefore arranged.

First.—That a line should be surveyed, on the left bank of the Fraser, from Moose to Cranberry Lakes, connecting with the surveys of 1872.

Second.—That the country should be explored, as far as time would permit, between the head waters of the North Thompson, the Clearwater, and the Horsefly Rivers.

Third.—That an intermediate route should be surveyed between those diverging from the common trunk at Clearwater, and terminating at Burrard and Bute Inlet respectively.

This would commence near the mouth of the Clearwater and leave the Thompson valley by crossing the watershed to the head waters of the Bonaparte, then descend that valley to the mouth of Hat Creek, and follow up the latter and through the Marble Canyon to the Fraser valley. Crossing the Fraser River near Lillooet, the line would follow the shores of Seaton and Anderson Lakes and a chain of connected valleys, alternately ascending and descending through the several ranges of the Cascade Mountains to the head of Howe Sound.

To carry out these surveys you decided that the party S, under Mr. Walter Moberly, which had passed the winter in the district to the east of the Yellow Head Pass, and since the opening of spring had been continuing the survey towards Edmonton, should turn back westward across the Rocky Mountains, as soon as a despatch could reach Mr. Moberly, to make the survey between Moose and Cranberry Lakes, and explore the country between the North or Cariboo branch of the Thompson River and the Clearwater Lakes.

For the survey between the mouth of the Clearwater and Howe Sound, a distance of about 280 miles, nearly half of which is through the rugged Cascade Mountains, you could only allow me two parties, with which there was barely time to complete the work before the close of the season, as it was now the 1st of June. However, you gave me two well organized parties, viz., Divisions M and X under Mr. E. W. Jarvis and Mr. C. H. Gamsby respectively.

In accordance with these arrangements you telegraphed instructions for Mr. Moberly to Fort Garry, to be forwarded thence, through the Hudson's Bay Company, to Fort Edmonton with which place he was expected to be in communication.

You also telegraphed Mr. Jarvis, who was at Fort Garry, to meet me, with his party at San Francisco.

Mr. Gamsby, with his party and myself, left Toronto on the 11th June; we arrived in San Francisco on the 18th, and in Victoria on the 24th of the same month. Mr. Jarvis and party arrived two days later; they had missed the direct steamer to Victoria, and had come *via* Portland and Olympia.

On the 27th June, Mr. Gamsby's party (X), had made all their arrangements, and got their supplies and baggage put on board the Dominion Steamer " Sir James Douglas" which had been put at my service, and in the evening I went on board with the party.

Saturday, June 28th.—At four a. m. we steamed out of Victoria harbour and at three p. m. the same day arrived at the head of Howe Sound; we got all the stores and baggage landed before night and the party camped, ready to commence work on Monday following.

I remained on board the steamer, and next morning started at daylight and arrived at Departure Bay, near Nanaimo, about noon to take in coal, which detained us an hour; we arrived in Victoria at seven, p. m.

On the 1st of July Mr. Jarvis and his party (M), accompanied by Mr. John Trutch, who was engaged to assist as commissary, left Victoria by steamboat for New Westminster and Yale, aud thence on the 4th, by stages to the mouth of Hat Creek, in the Bonaparte Valley, where they encamped on the 8th July, and next day commenced surveying a line westward towards Lillooet.

I now ordered a pack train of thirty-five horses and mules to be sent down from Cache Creek to New Westminster, and organized a party under Mr. Joseph Hunter, to cut a trail for this train to work on, in connection with the surveying party (X), from Howe Sound.

This trail party left Victoria on the 8th July by the regular steamer for New Westminster, where they arrived the same evening; the pack train arrived two days later, and Mr. Hunter engaged the steamer "Hope" Captain Parsons, to convey his party and the train to Howe Sound; they left New Westminster on the evening of the 11th July, and early next morning they landed everything safely on the banks of the Squamisht River, a mile above the head of the Sound, where the party commenced cutting the trail.

Meanwhile an express had arrived at Kamloops, from Mr. Moberly's camp on the east side of the Rocky Mountains; and, judging from the position Moberly was in, I had doubts of your despatch from Ottawa of June 5th, reaching him in time for him to complete the surveys, according to your instructions, before winter set in.

I therefore immediately sent off a despatch to him, repeating your instructions, with a sketch showing how you wished the line to be run between Moose and Cranberry Lakes, and giving the average grade between the two points; also showing what explorations were required between the head waters of the North Thompson and Clearwater Rivers.

Journey from Howe Sound through the Cascade Mountains and up the Bonaparte River.

Having now got all the parties fairly at work, I was ready for an exploratory journey from Howe Sound through the Cascade Mountains, on the route now being surveyed, and up the Bonaparte Valley, whence the surveys would be connected with those of the previous year.

Friday, 25th July.—The steamer "Sir James Douglas" having been put at my service, I embarked at mid-night, and half an hour after we steamed out of Victoria harbour, and at noon next day we arrived at the head of Howe Sound, where we found Mr. Hixon waiting for us with two canoes and seven Indians, whom he had engaged at Burrard Inlet to go with us as packers, &c.

Here we also met a canoe with two white men and two Indians from Mr. Hunter's camp; one of the white men who had, been employed in cutting the trail, had a leg badly fractured by a falling tree, and I sent him to Victoria by the steamer; the others joined my party.

The valley at the head of Howe Sound is about a mile and a half to two miles wide; it is a low delta formed by the Squamisht River, which enters the sea by two arms, one at each side of the valley. This delta is covered chiefly with cottonwood or poplar trees. At low tide from half a mile to a mile of mud flat is uncovered, and it is fully half a mile from this ere the water is of sufficient depth to float a vessel drawing twelve feet of water; then the bottom suddenly slopes down to very deep water, thus affording very poor anchorage.

The left or east branch of the river, just before entering the Sound, washes the base of a bold granite bluff, probably over 1,000 feet in height; it was near this that the surveys were commenced.

The fork of the river is about two miles above this, where a small stream called the Namquam comes in. Here the valley widens out, and the flats, up to the foot of the mountains, are covered with a fine quality of spruce, hemlock and other varieties of fir; the banks of the river are fringed with a dense growth of cottonwood trees. The tide flows up to the fork, but above that the river is very rapid, with numerous shoals, and we had great difficulty in forcing our large sea-going canoes up.

About seven miles from the head of the Sound, the Tsee-ark-a-misht River comes in from the east side of the valley, which is here fully a mile and a half wide, and flows into the Squamisht; the former river is fifty to sixty yards wide, and the latter a hundred to a hundred and forty yards.

On the west bank of the Squamisht, near the confluence of the two rivers, the rocky slopes of the mountain come close to the water's edge, and an Indian village is perched on a bench of the rocks.

We arrived here on Sunday about noon, and made a depot of provisions for the use of the men on their return home.

Here we left our canoes and engaged two more men to pack for us till we should reach the camp of the surveying party. After lunch we commenced our tramp, following the left bank of the Tseearkamisht; two miles up we crossed the line cut by the surveying party, and a mile further found the Indian with a small canoe whom we had sent on ahead to ferry us across the river. The crossing detained us over an hour, as the river was swift and the canoe very small, so that several journeys had to be made. Half a mile above this we camped on a high bench.

Monday, 28*th July*.—Started at seven a.m. on the left bank of the river, the valley getting narrower as we ascended. About six miles on we crossed the Minatch River, 60 feet wide, and about four miles above this the valley closes in, the river issuing through a rocky canyon. Here we turned to the east, following the trail cut for the pack train, and in half a mile we had ascended 500 feet to a small lake about 300 yards long; still ascending, in two hours we came to a depot of stores belonging to the surveying party, and camped, No. 3.

Tuesday, 29*th July*.—Started at seven a.m., and still following the zig-zag trail up the mountain, we soon reached an altitude 2,000 feet above the level of the sea. We then began to descend, and reached the valley, at the head of the canyon, about five miles above the point where we had left it.

Here the valley for a mile and a half in length, and little less than a mile in breadth, is covered to a great depth with boulders and debris that have been washed down by the bursting of a lake on the side of the mountain, leaving an immense gorge in the latter, and damming up the river so as to form a lake two miles in length; this is called Daisy Lake, and the are trees standing in it with several feet of their trunks submerged, shewi that this disruption is of recent occurrence, probably within twenty thirty years. On the shores of this lake we met Mr. Hunter, who h charge of the trail party, whose camp was a short distance ahead.

Wednesday, 30th July.—We started early, following Mr. Hunter's tr which had been carried well up the slope of the mountain to avoid hea fallen timber and swamp in the bottom of the valley; in the evening reached the camp of the surveying party at the head of Daisy Lake, wh we also camped, No. 5. Here I had an opportunity of correcting readings of my aneroid, and found Daisy Lake to be 1,177 feet above level, and our camp a little over 24 miles from the head of Howe Sound

At the head of Daisy Lake the valley is covered with very large cott wood trees, but in little more than a mile further up, the river rushes of a canyon through volcanic rocks, making two very sharp reverse ben I spent two days here examining the country with Mr. Gamsby, while party were making canoes and rafts with which to cross the river.

Friday, August 1st.—Some of my Indians having got sick or foot-so I borrowed a few men from Gamsby to replace them; we crossed the riv on a raft, and after lunch resumed our tramp. The bottom of the vall here rises abruptly to 400 feet above the river on to a plateau of volca origin; the loose rocks or lava beds are piled up in cones or serpenti ridges, sometimes forming the walls of crater-like basins or ponds risi one hundred to two hundred feet above the general surface. On the e side the Tseearkamisht River rushes through a tortuous canyon, and the west a stream 30 to 40 feet wide tumbles down in cascades from snow clad mountain slopes; we followed midway between the two by narrow dry valley, and in less than three miles again struck the river ne where it is divided into two branches, one coming from the north-east a the other from the north-west; these are nearly of equal volume, forty sixty yards wide, very rapid, and now at high flood from the melting the snow on the mountains.

We had no means of crossing so as to get between the forks and, the fore, followed up the west branch, but very doubtful whether we were the right route, as the only account we had of it was that of the late M Jamieson, who had come from the opposite direction (Lillooet) and de cending the small stream from the Green Lakes, had crossed the ea branch of the river higher up by the Indian trail, and probably had n seen the west branch at all as he takes no notice of it.

At five miles above the fork the west branch is divided into tv streams, each 75 feet to 100 feet in breadth, and a short distance abo that a glacial stream 20 feet wide enters from the southwest.

At 13 miles above the first fork we found we were 3,375 feet above s level, and the valley was rising rapidly; a mile and a half above that poi a stream 40 feet wide comes in from the north. We ascended the mou tain side opposite this to a height of 700 or 800 feet, from which we cou trace the course of the stream to the snow line on the mountains fro which it fell by a succession of rapids and beautiful waterfalls.

Descending to the valley we followed the west branch a mile furth up to a deep Canyon through which the torrent rushed, and above this we could see it falling in cascades down the mountain side; I estimated the height at foot of the Canyon 3,560 feet above sea level.

We were now sure we were on the wrong route and commenced our return journey, keeping well up on the slopes of the mountain from which we could command a good view of the valleys leading in the direction in which, we supposed, the Green Lakes lay.

Our progress was slow and laborious for, besides loose rocks and fallen timber, there was a dense growth of brush over six feet high resembling blackthorn, and a drizzling rain came on, which lasted the two days occupied in returning to the surveyors camp, which we reached on the afternoon of the 4th of August.

During the next two days it rained too much for the surveyors to work, but the trail party had now got a fine large canoe finished, with which they managed to get all the supplies safely across the rapid and dangerous Tsee-ark-amisht River, which was now at high flood, and by the end of the week such progress had been made that we all camped together, three miles further on, between the forks of the river, having crossed the west branch by a rude bridge which the surveyors had conconstructed.

The surveys were also carried to this point, but as the grades were not satisfactory, I sketched a more circuitous line, diverging from the first about five miles back, which the party now commenced to survey.

As we were now near the summit of the first range of mountains, and the trail party, with the supplies, had got fairly up with the surveyors, I had reason to think that the greatest difficulties of the survey through the mountains were passed.

Monday, 11*th August*.—We resumed our tramp, accompanied by Mr. Hunter, following up the valley of the east branch of the Tsee-ark-amisht, which we found covered with volcanic debris for about two miles where the mountain slopes abut on the river; a mile and a half beyond this the small clear stream from the Green Lakes enters the valley, following this up three miles, we reached the south end of these lakes, where Mr. Hunter was rejoiced to find abundance of good grass, which the mules greatly needed, as they were getting very weak through want of feed.

This string of small lakes is about 8 miles long, and 2,100 feet above sea level; it is on the crown of the first or coast range, and the watershed between the streams falling into Howe Sound, and those taking a more circuitous course by Lillooet and Harrison Lakes to the Fraser River. There are large flats or meadows of good grass on the margins of these lakes, and the mountains immediately surrounding them are detached or in broken ranges rising 1,000 to 2,000 feet above the level of the lakes; some with summits of bald rock, but mostly covered with timber of little value. Westward the snow-clad Sierra, purple in the distance, rises in rugged grandeur barring a passage to the coast.

Here Mr. Hunter left us to return to his party; we followed a line generally parallel to the lakes, sometimes making a short cut across a mountain spur.

At the north end of the lakes the valley is contracted, and a river about 40 yards wide issues from the lakes, and for three miles flows between narrow benches varying in height from 50 to 200 feet; below this the benches disappear, and the rapid river flows between rugged mountain slopes; on the east side the mountains are high and precipitous, but we were travelling on the west side on a foot hill covered with huge masses of detached rocks piled in most bewildering disorder. I had doubts of the pack train being able to cross this, but subsequently learned that Mr. Hunter succeeded in finding a practicable pass on the other side of the range.

This rough country continues about four miles, when the range of foot hills drops down and the valley opens out; about ten miles from the foot of the Green Lakes, two rapid rivers, 30 to 40 yards wide, come in from the west within a mile of each other, with an arid flat between them covered with small scrub firs. We had to cross one of these rivers by an Indian bridge of the most slender construction, a few poles lashed together and suspended from the top boughs of a leaning, or half fallen tree which reached about two-thirds across the river, and fastened at the other end to a stump; we strengthened this, but the passage was anything but pleasant, with a swollen mountain torrent rushing beneath.

A mile beyond this a foot hill, or spur from the mountain, 300 feet high closes up the valley, and the river dashes through a Canyon over a mile in length in which there are two waterfalls of 70 and 50 feet respectively. Beyond this the valley descends rapidly to the Pemberton meadows, where the Green river, which we had been following on a course nearly north, is suddenly deflected to the east by a detached round hill mile or more in diameter which almost closes up the mouth of the valley this hill rises about 400 feet above the level of the meadows. We ascende this, and from our elevated position had an extensive view of this gre basin in the heart of the cascade mountains which separates the Lilloo spur from the coast ranges. Far away to the northwest we could trac the valley of the Lillooet river which by numerous lateral valleys collect the melted snow from the distant mountains and entering the extensiv meadows which lay at our feet, mingles its waters with those of the Gree river, on the banks of which we had been travelling, the Birkenhea river from the north, and other small streams flowing in an en less intricacy of channels through these meadows to the Lillooet Lake, an thence by the Harrison Lake and River entering the Fraser below Fo Hope.

The Indians told us that the Lillooet river is navigated with cano 40 miles above the point where we stood and that there are extensiv meadows on its banks; the flats called the Pemberton meadows exten from the Lillooet lake westward about ten miles and are from two to fou or five miles in breadth.

We descended the north side of the hill and camped—No. 15—by small lake, on Thursday, 14th August; we had been four days coming fro the Surveyor's camp—under 30 miles—the weather was very warm, th country rough, without even an Indian trail, the men were very tire and glad to rest half a day while I completed my rough topographic sketches, shewing the line to be surveyed; these I sent back to Mr. Gamsb with two of his packers who had come with me from his camp.

Friday, 15th August.—A large canoe which I had engaged at an Indian camp, a few miles distant, arrived at three p. m.; in this we embarked with all our baggage, and, threading the intricate water courses, in two hours reached the mouth of Birkenhead river, on the north side of the Pemberton meadows; we thus followed up the valley of this stream, by an Indian trail, and next day, at nine a. m., struck the waggon road, on the Pemberton portage, at a point about 12 miles from Lillooet lake: following this road seven miles we entered the Scaalux valley, coming down from the north east; the road follows up this, and three miles more brought us to the Half way house, near to which we camped—No. 17—on Saturday evening.

This is on the well known Douglas route by which the interior of the country was reached, before the waggon road was made from Yale, up the Fraser, Thompson, and Bonaparte valleys to Clinton; it is now chiefly used by Indians, as there are only two or three white settlers in the neighbourhood, and the road is overgrown with grass and brush that have sprung up since the travel was diverted.

At the Half-way house Mr. Frank Harvie met us; he had a large canoe waiting for us at the head of Anderson lake, and a small pack train of mules near the town of Lillooet; so I discharged all my packers, sending back with them more topographical sketches for Mr. Gamsby.

Two miles beyond the Half-way house there is a small lake, on the water shed between Anderson and Lillooet lakes; this is the second divide on the line we have been travelling from Howe Sound.

From this the waggon road follows a narrow valley about ten miles down to Anderson Lake, which we reached on the 17th August, having hired a waggon from Mr. Poole, at the Halfway house, to carry our baggage.

Anderson and Seaton Lakes cut through the Lillooet range of the Cascade Mountains; the former is about 14 miles long, bearing northeast. The mountain slopes on both sides of the lake come down to the water's edge, but the southeast side is the most precipitous, and on it there are a number of loose rock slides, down which fragments of rock from the cliffs above are ceaselessly rolling.

On the northwest shore, though the line appears more irregular, the slopes are at an easier inclination and the rocks are firm; except on about a mile and a half at each end of the lake where the high cliffs project into deep water.

Between the two lakes there is a portage about two miles in length, through which a river 100 feet wide rushes with great velocity, as the difference of the level of the lakes is about 60 feet.

Seaton Lake is about 16 miles long, of a serpentine form, but its general bearing is nearly due east. Looking down from the head of it a magnificent picture of mountain scenery is presented. The lake is only about 800 feet above the level of the sea, and the surrounding mountains rise abruptly 3,000 to 5,000 feet, with many gradations of hue as they recede in the distance.

The rocky slopes on the south side of this lake are abrupt and broken, with many slides of loose rock; on the north side the slopes are gentle or terraced, covered with bunch grass and dotted with firs, except for about a mile at each end where bold cliffs line the shores of the lake.

At the foot of this lake we found the line stakes and closing bench mark of the M Division, who had reached this point a fortnight before, and had gone back to Hat Creek to survey a line up the Bonaparte Valley.

A mile from the foot of Seaton Lake the Cayoush River from the south east joins that issuing from the lake, and about two miles further on the united streams flow into the Fraser a little below the Town of Lillooet where we arrived about noon on the 19th August and camped—No. 20.

I spent the rest of the day in paying off Indians and completing my topographical sketches of the shores of Anderson and Seaton Lakes, which I sent back to Mr. Gamsby, who was in charge of the surveying party Division X.

The Town of Lillooet was a thriving place a few years ago, when it was an important station on the Douglas route to the Cariboo gold mines but now—except an hotel, a post office, and two or three stores—it is chiefly occupied by Chinese and Indians.

The valley of the Fraser for a few miles below and twenty miles above Lillooet, is in some places of considerable breadth, and there are a number of very fine farms on the benches, each side of the river, most of which require irrigation, which is supplied from the lateral streams flowing down the mountain slopes. But the uncultivated benches and slopes which cannot be irrigated—once covered with luxuriant bunch grass—are now bare and arid, or maintain a sparse growth of wild sage or wormwood.

The valley is well sheltered and, lying low, is very warm; it is said to be the finest district for gardening and fruit growing on the mainland of British Columbia.

But the valley of the Fraser, wherever we have touched it, presents engineering difficulties in railway construction of a very grave character. Though from Lillooet to the Marble Canyon, 22 miles up the valley, the Superior Mountain ranges do not press very closely on the river, yet the foot hills or benches rising several hundred feet above its level are in some places rocky and serrated, forming short Canyons; and deep gulches are cut in the alluvial benches by the streams descending the mountain slopes.

Wednesday, August 20th.—We crossed the Fraser by ferryboat, then travelled along the waggon road up the valley, at a brisk pace; our pack train being fresh, we soon reached the 21 mile house near which w camped.

Next day we resumed our journey; about the 22nd mile the road begins to ascend the Pavillion Mountain, but we turned to the east and entered the Marble Canyon.

This is a narrow gap or pass between the Fraser and Bonaparte Valleys, about 2,700 feet above the level of the sea, and 11 miles in length bearing southeasterly till it joins the valley of Hat Creek. It looks like a groove cut through the mountains, the white cliffs of limestone or marble rising abruptly on each side from two to three thousand feet in height turretted with huge irregular masses of rock, which glisten in the sunbeams and form an endless variety of light and shade.

In the centre there are two small lakes, one four miles and the other a mile in length; at the north end there is a fine farm owned by Captain Martley, by whom we were kindly entertained; the south end is arid and dotted with fir trees.

The valley of Hat Creek, from the marble canyon to the Bonaparte, is about 13 miles, and has a rapid descent; it is narrow at the bottom, in which a stream 20 to 30 feet wide flows; but the slopes on each side rise at an easy inclination, though they are rock-ribbed, and serrated by the streams coming from the mountains; the scant soil that covers the rocks supports a growth of bunch grass and wormwood. We arrived at the Bonaparte River on the 21st August, and camped, No. 22. The ride through the Marble Canyon down to this point was the pleasantest we enjoyed the whole season.

The Bonaparte River has its sources about 70 miles north of the point where we were now camped, in a number of lakes on the elevated central plateau between the Rocky and Cascade Mountains, and flows into the Thompson River about 40 miles above the confluence of the latter with the Fraser.

The valley is narrow, the bottom flat varying from two or three hundred feet to half a mile in breadth, thickly covered with poplar and alder bushes; in several places these have been cleared off and very fine farms obtained. Up towards the head waters the valley expands at intervals, forming very fine natural meadows.

The slopes throughout are rocky but not precipitous, and they are generally covered with a thin coating of earth, which supports a luxuriant growth of bunch grass and wormwood, and dotted with firs to their summits, giving the whole country a park-like appearance.

Friday, 22nd August.—We moved our camp six miles up the valley, and next day Mr. John Trutch joined our party; we proceeded together up the valley on a good trail, and in the evening reached the foot of the great chasm which extends two or three miles north-westerly to the waggon road; its maximum depth is about 1,500 feet.

We expected to find Mr. Jarvis and his party (M) here, but they had moved on two days before, and were now 15 miles farther up the valley.

As I could not spare the time to go any farther at present, I sent a messenger for Mr. Jarvis, and after settling all business matters with him, I rode to Clinton, where I spent two days in examining and paying accounts.

On the 27th August I took the down stage to return to Victoria, where I arrived on Saturday, the 30th August.

SECOND JOURNEY ON THE MAINLAND.

Friday 19th Sept.—I set out on my second journey on the mainland, by the regular steamer to New Westminster where I met Mr. A. S. Hall, commissary to the S. division under Mr. Moberly, from whom I learned that the latter had received your instructions to return to the west side of the Rocky mountains, on the 29th of July; and that the party began to return on the following day and arrived at Moose Lake on the 18th of

August, where they commenced the survey on the 20th down the left bank of the Fraser; he also informed me that a few days later my messenger, Mr. W. Dewdney arrived with full instructions respecting the surveys and explorations to be made, and remained with the party. Mr. Hall was on his way to Victoria to arrange his accounts when I met him at New Westminster.

I arrived at Clinton on the 24th of September, where I met Mr. Hunter, who had completed his work in connection with the X Division and his pack train was now on the way to winter quarters at Kamloops.

I took Mr Hunter with me to the 111th Mile House near Lake la Hache where my small pack train was waiting for me, it having arrived some days before, from the camp of the M Division on the head waters of the Bonaparte river, where it had been employed by Mr. Jarvis in my absence. We made a short exploration north easterly from Lake la Hache with the object of finding a better route thence to the North Thompson than that surveyed in 1872. We found two routes that looked favorable, one bearing a little to the east of north that would strike the valley of the Horse Fly, and the other branching out of this and bearing more easterly would strike the Clearwater Valley north of the line of 1872. I put my pack train and men in charge of Mr. Hunter, with instructions to make a running traverse of the first route with compass and aneroid, and to follow up the Horsefly River beyond the range of hills that crosses from north to south.

Mr. Hunter commenced his survey on the 29th of September, and I went to the 150 mile house to settle some accounts, and thence returned to Bridge Creek (100 mile house), where I hoped to get some tidings of the M division under Mr. Jarvis. The last despatch I had from him was dated a month before, when the party were near the divide between the Bonaparte and Thompson Rivers, at an elevation of 3,700 feet above sea level; and contrary to expectation, had not found any cross valley or pass between the Bonaparte and Thompson Valleys, and were then within 500 or 600 feet of the general level of the plateau. As the descent from the divide to the bottom of the Thompson Valley would be about 2,500 feet, the line would be necessarily lengthened to get down with a moderate grade; I therefore allowed a fortnight beyond the time Mr. Jarvis had estimated to complete his surveys, and employed myself in making short explorations in the neighbourhood.

Thursday, 16th October.—Mr. Hunter returned to the 111 mile house; his survey had been very satisfactory, as he found a very favourable line by a chain of small lakes bearing north-easterly, thence by a small stream to the Horsefly River. He travelled one day up the banks of the river through the cross range of hills, and found no canyon; and eastward, as far as he could see with his field glass, there were no hills, but the country was rising gradually, and the valley where he stood was about 3,000 fee above sea level.

Saturday, 18th October.—Mr. Jarvis with his party M arrived at Bridg Creek, having completed their survey to the Thompson River and connected their line with the surveys of 1872, a few miles below the mouth o the Clearwater.

I paid off most of the men of Jarvis' party, and sent half the officers to Victoria to work at the plans and profiles.

I then made up a party to explore the route from Lake la Hache to Clearwater, and put Mr. Jarvis in charge. He started on the 20th of October, taking with him two assistants, three men and a pack train of nine mules.

I started the same day for Kamloops where I expected to meet Mr. Moberly and his party (S). Next day at Clinton I had a despatch from Mr. Gamsby, stating that his surveys were nearly completed, and he would be at Lillooet with the party in a few days. I therefore immediately made arrangements to have the party and their baggage conveyed by boat to Lytton and thence by coach and waggon to Yale.

I arrived at Kamloops on the 23rd October and found there Mr. A. S. Hall, who had returned from Victoria with the accounts of the S party made out, I waited there several days, paid off the men who had returned in charge of the pack train from Division X, settled sundry other accounts and made arrangements with Mr. Barnard for the herding of the pack animals during the winter.

Monday, 27th October.—Mr. Moberly's party had not arrived, and, as I could not wait longer I placed money, to pay off the men when the party arrived, in the hands of Mr. Tait, the officer in charge of the Hudson's Bay Company's post there, and started on my return to Victoria in a small steamer owned and commanded by Mr. Tolmie, who kindly took a course close by the north shore of Kamloops Lake, giving me a good opportunity of examining the same, and which I found even less favorable for a railway than the south shore; the rocky slopes coming close to the water's edge throughout the whole length of the lake and, at several points, the high cliffs running into deep water.

Before reaching the lake, on the right bank of the Thompson River, I had the pleasure of inspecting a flour mill recently enlarged and put in excellent order by the owner, Mr. Fortune, who is now in a position to do a large business. From this and other mills further north all the flour necessary for future surveys, and even construction could be obtained; also, beans, cattle, sheep and bacon, can now be had in the country, and the great delay and expense of importing and forwarding these supplies, will in future, be in a great measure avoided.

From Savonna's ferry Mr. Barnard conveyed me to Yale, where we arrived on the 30th of October and found Mr. Gamsby and his party (X) waiting for the steamer "Hope," by which we all went together next day to New Westminster, and thence by steamer "Maude" to Victoria where we arrived on the first of November.

I paid off the men, and the officers of the X party worked at their plans and profiles until the 12th of November, when those who had come from Ottawa left Victoria in the steamer "Prince Alfred" on their journey home.

Mr. Moberly and his party (S) arrived at Kamloops about the third of November, where most of his men were paid off except those returning to Victoria.

He had completed the survey between Moose and Cranberry Lakes, by the left bank of the Fraser, with satisfactory results; and commenced the exploration from the fork of the Thompson and Albreda Rivers on the 14th of October, getting about 23 miles up the valley of the former, near to the pass between it and the Clearwater, when a heavy snow storm coming on he was obliged to return. He arrived in Victoria with the officers of his party on the 10th of November; some of those went to Ottawa, and the others having completed their plans and profiles at the beginning of December were paid off, and Mr. Moberly left Victoria with me on the 10th of December for Ottawa.

ENGINEERING CHARACTER OF THE LINES SURVEYED IN 1873.

East of the Rocky Mountains towards Fort Edmonton.

In my report on the surveys of 1872 I described the engineering character of the line surveyed from the summit of the Yellow Head Pass eastward, by the Caledonian and Jaspar Valleys to Fiddle River, a distance of 49 miles, to which point the surveys had then been carried.

I may state again, briefly, that this point is 3,304 feet above sea level, or 442 feet lower than the Yellow Head Pass, giving an average grade of about nine feet per mile; but the grades are variable, the highest being 1 per 100 for about 2½ miles.

In this distance of 49 miles the works will be generally light o medium, with a few exceptions where the line runs on the rocky slopes o the mountains, requiring a considerable quantity of rock excavation; th aggregate length of line, on which this class of work occurs, is about fiv miles; the crossing of the Athabasca river on the line surved in 1872 is 41 feet in length, but the bridging on the line proposed, about 45 miles furth down the river, will considerably exceed that length; it will, however, b in shallow water.

From Fiddle River the surveys during 1873 were continued eastwar 114 miles to a point near Root River, between the McLeod and Pembin rivers, estimated to be about 125 miles from Fort Edmonton.

The line surveyed is, as nearly as practicable according to the sketc and instructions you gave Mr Moberly when you met him in the Yellow head Pass in 1872, and it runs south of the trail by which you travelled.

This line however, runs on very high ground, at some points reachin a greater altitude than that of the Yellow Head Pass, with unfavourabl grades the particulars of which will be found in the following:

From Fiddle river eastward for half a mile the grade is nearly leve thence there is a rising grade of 75 feet per mile for over 6¼ miles, wit some heavy cutting, to the divide between the Prairie and Athabasca river the former being a tributary of the latter, and falling into it about 18 mil to the northeast.

From this point the grade is nearly level for three quarters of a mile thence eastward, a little over 8 miles, to Prairie River, the fall is 413 fe or 51½ feet per mile; the grades however, vary considerably, the highe being 62 feet and the lowest 21 feet per mile.

The works on this portion will generally be light, as the cuttings a not deep and they are principally in sand or light loam; crossing Prairie River will require 40 feet of bridging.

From Prairie River to Deep Creek, on the divide between the McLeod and Athabasca, the distance is 21½ miles and the rise is 628 feet with variable grades, the highest being 64 feet per mile for 3½ miles.

The work on this portion will be medium, there will be some cuttings of considerable length in sand and clay loam, but no rock cuttings.

The descent from Deep Creek to the McLeod River is 473 feet, in a distance of 15 miles with variable grades, none exceeding 1 per 100, except on the last mile and one third, the grade of which is 70 feet per mile. The work will be medium cutting and filling; no rock work.

The altitude of this last point, on the left bank of the McLeod River, is 3562 feet above sea level; thence down the valley 48 miles, to the point of crossing the river, the fall is 769 feet, giving an average grade of 16 feet per mile; the grades however, are undulating, the highest being 70 feet per mile for half a mile, the next 68 feet per mile for three quarters of a mile, all the rest are under 1 per 100·

The works on this portion will be light cuttings in sand, gravel and clay loam, with the exception of two short excavations in soft sandstone.

The bridge across the McLeod River will be about 675 feet in length, the altitude, 2793 feet above sea level.

From the crossing of the McLeod the line rises 231 feet in 7½ miles with variable grades, the highest being 64 feet for one mile; thence to the end of the survey, 5½ miles, the rise is only six feet, the altitude of that point being 3030 feet above sea level, but the grades are undulating, the highest being 63 feet per mile for two thirds of a mile.

The work between the McLeod River, and the end of the survey will be generally light, the heaviest being the embankments across some muskegs; there will be no rock work.

The above description applies to the trial or preliminary line that was surveyed, which is, however capable of great improvement on the line proposed by Mr. Moberly. Crossing the Athabasca farther down near Old Man's River as shewn on the map, it is expected that the highest grades will not exceed 1 per 100 and that the excavations will be considerably reduced; the bridging of the Athabasca will, however be lengthened, but in shallow water where the current is not strong.

From the end of the survey to Fort Edmonton the estimated distance is 125 miles, and the altitude of the latter as given by Captain Palliser is 2,088 feet above sea level, or 942 feet lower than the last point on the survey, giving an average fall of about seven an a half feet per mile; but the grades will be undulating; first dipping to the Pembina river, then rising to the watershed between that and the Saskatchewan, and again falling to the valley of the latter.

The excavations on this portion are not expected to be heavy; the most important work will be the bridging of the Saskatchewan river.

WEST OF THE ROCKY MOUNTAINS BETWEEN MOOSE AND CRANBERRY LAKES.

From Yellow Head Pass westward, that portion of the line between Moose and Cranberry lakes has been re-surveyed. From Moose lake the new line follows the right, or north, bank of the Fraser about three miles, on gravel benches, nearly level, with light work. It then crosses the river and follows the Fraser valley 17½ miles, gradually leaving the river, and running on the slopes with an average descending grade of 35 feet per mile; the only variations from a uniform grade being one of 43½ feet per mile for a mile and a half, and another of 21 feet per mile for about the same distance.

Of the 17½ miles above referred to about six miles are on granite, the same distance on slate rock, and the balance on shale. The works wil therefore be rather heavy though the cuttings are not deep; there will be 3 tunnels, the united lengths of which will be 2,600 feet. From this point which is opposite Tête Jaune Cache, the line takes a southerly course into Cranberry Valley, descending obliquely its southern slope for about six miles, till it rejoins the line surveyed in 1872, from three to four miles north of Cranberry Lake. On this six miles the work will be rather light, and there will be no rock cutting.

BETWEEN THE NORTH THOMPSON VALLEY AND HOWE SOUND. *

Commencing at the head of Howe Sound near the east side of the valley the line runs on the bottom flats about nine miles, crossing the east branch of the Squamisht river, 280 feet wide, at the second mile, and the Tsee-ark-amisht river, 200 feet wide, between the eight and ninth mile which is 142 feet above sea level. The work up to this point will be light

The line now follows the Tsee-ark-amisht valley on a course nearly north; at the ninth mile it crosses a spur from the mountains which wil require a tunnel 370 feet in length.

Between the 11th and 12th mile, the line recrosses the Tsee-ark-amish river, requiring 270 feet of bridging.

These two crossings of the river could be avoided, but this would necessitate some heavy rock cuttings and a short tunnel as the rocky slope of the mountain comes close to the bend of the river in a very irregular line

From this point the first line surveyed followed the banks of the river on a flat bench to the 16th mile, but there the valley closes in and the river rushes through a rocky canyon, about three miles and a half in length in which distance it falls 600 feet.

To avoid an impracticable grade at this difficult point a deviation of the line commences at the 12th mile and runs on the rocky slopes of the mountain to the 19th mile with a grade of 1.80 per 100 or 95 feet per mile for three miles, and another of 2 per 100 for four miles.

On this seven miles there will be some heavy rock cuttings, including ten short tunnels of an aggregate length of 6,000 feet; four crossings of the Tsee-ark-amisht river, 120 feet each, and one of the Minatch river 100 feet

The line at the head of the Canyon is 1,015 feet above sea level.

On the next four miles, one of which is on the east shore of Daisy lake, the work will be medium, with the exception of one rock cutting 700 feet long and 25 feet deep. The rise on this length is 228 feet with grades varying from 66 to 106 feet per mile.

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* The line was surveyed from Howe Sound to the North Thompson, which was also the way I travelled and here describe it; but the mileage on the Diagrams runs from the Yellow Head Pass westward.

Two miles beyond this, is the foot of the second canyon, through which the river falls 425 feet in three miles. To avoid an impracticable grade the line was again forced to leave the bottom of the valley and rise on the rocky slope of the mountain with one grade of 105 feet per mile for two miles and a half, and another of 79 feet per mile for a mile and a half, to a point between the 27th and 28th mile, at an elevation of 1,635 feet above sea level.

In this last 4½ miles there will be some heavy rock cuttings, including three tunnels making together 2,000 feet in length. There are also some deep cross ravines to bridge or fill up, one of which is 125 feet deep, 500 feet wide at the top and tapering to a point at the bottom.

From this point to the 34th mile on the shore of Green lake the rise is 466 feet, that point being 2,101 feet above sea level; the grades to this are variable, the highest being 105 feet per mile for two and a half miles.

The east branch of the Tsee-ark-amisht is crossed about the 30th mile where it is 100 feet wide; near this there will be two tunnels through rocky spurs, one 400 feet, the other 700 feet in length; the rest of the distance will be rock cuttings and embankments of no great depth.

The next seven miles the line runs along the shores of the Green lakes with easy undulating grades, the highest point reached being 2,110 feet above sea level. On this portion the work will be rather heavy as several of the cuttings are 30 to 40 feet at their maximum depth, the lower parts of which will be in rock, and 700 to 1,000 feet in length. There will be a tunnel 400 feet long through granite; the largest stream crossed is 30 feet wide.

From the north end of Green lakes the line follows the left bank of the Green river, 15 miles to the Pemberton meadows, falling in that distance 1,411 feet or an average of 94 feet per mile, the highest grade being 106 feet per mile for two miles and a half and the lowest 74 feet per mile for two miles.

In this 15 miles the works will be heavy, the line running on the rocky slopes of the mountain, there will be a great number of rock cuttings; the heaviest of those are ten in number averaging 600 feet in length and 35 feet maximum depth. Four tunnels will be required, their united lengths amounting to 2,750 feet.

Near the 47th mile Cliff river is crossed, it is 150 feet wide; and three miles farther on the Ischawham river 120 feet wide is crossed.

The next four miles the line runs on the Pemberton meadows, nearly level, 693 feet above the sea, with light earthwork; but the Lillooet river where the line crosses is 600 feet wide and about 10 feet deep with very little current.

From the Pemberton meadows the line ascends to the summit of the next range. Pemberton portage by the Birkenhead and Scaalux rivers, about 12 miles, at an average rise of 77 feet per mile, the summit being 1,615 feet above sea level, the grades varying from one of 100 feet per mile for three miles to one of 40 feet for one mile.

In this length there will be a number of cuttings, through sharp rocky spurs, averaging about 400 feet in length and running up to a point in the centre 20 to 35 feet in height. There will also be six short tunnels, their united lengths amounting to 2,000 feet; also one crossing of the Birkenhead River 120 feet.

From the last point the line runs nearly two miles on the crown of the ridge, falling in that distance 36 feet; in this there is one rock cutting 700 feet in length running from grade level at each end up to a point in the centre 40 feet in height.

From this the line descends by an open valley 11 miles to the shore of Anderson lake, falling 690 feet; the point at the lake shore being 889 feet above sea level and 40 feet above the level of the lake.

In the first four miles of this portion the grades vary from 79 to 92 feet per mile, with heavy work, the cuttings being chiefly in rock including two tunnels, one 500 feet and the other 300 feet in length.

On the next two miles the grades are easy and the work medium, the cuttings being chiefly in gravel.

On the balance of the distance the grades vary from 55 to 95 feet per mile with some heavy rock cuttings, including five tunnels aggregating 2,000 feet in length.

From the last point the line follows the west shore of Anderson lake to its outlet, a distance of 11 miles, with easy undulating grades, but with heavy work, as the mountain slopes come close to the water's edge and there are a great number of sharp rocky ridges to cut through, in which there will be required six tunnels amounting together to 3,200 feet in length.

Near the head of Seaton lake a rocky promontory projects into deep water with a very irregular face; to avoid this the line was carried over a neck or depression at a considerable distance from this lake rising with a grade of 2 per 100, over three miles.

On this length there will be some very heaving cuttings and embankments, and one tunnel 1,900 feet in length.

From this neck the line descends to the shore of Seaton lake with a continuous grade of 1 per 100 for six miles, on which the work will be medium with the exception of a tunnel 300 feet long through a spur of rock. Thence to the outlet of the lake, about 7 miles, the line is nearly level; on half of this distance the work will be medium, but on the other half there are several places where the mountain slopes abut on the lake in high vertical cliffs, requiring seven short tunnels amounting in the aggregate to 2,200 feet in length.

The last point is 803 feet above sea level and 10 feet above the level of Seaton lake. From this to where the line crosses the Fraser river, near the Town of Lillooet, the distance is a little over three miles, in which the fall is 103 feet, with easy grades, and the work will be medium, the cuttings being in clay or gravel.

The crossing of the Fraser near Lillooet is 117 miles from the starting point at Howe Sound and the line at the former may be considered as fairly through the Cascade mountains. From this point eastward will therefore be described as another Division of the line

On the whole length of this line through the Cascade mountains, the works on 13 miles will be light; 17 miles medium, and the balance 87 miles, heavy, in which 44 short tunnels are estimated, making together 5½ miles of tunnelling.

The grade line at the crossing of the Fraser, near Lillooet, is 700 feet above the level of the sea; from this the line creeps up the east side of the Fraser valley, obliquely, with an ascending grade of 1.50 per 100, or 79 feet per mile for 25 miles; the only variations in grade being one of 1 per 100 for a mile, and one of 2 per 100 for two and a half miles.

Only about two miles of this is on gravel or clay; the rest is all on rock on a steep hill side, in which there will be some very heavy rock cuttings from 300 to 2,000 feet in length, with a maximum depth of 25 to 80 feet, the cross section showing a surface inclination of about 1 to 1.

There are also a great number of lateral ravines or gullies to cross, which have been worn out by the streams descending from the mountains; most of these are dry in summer, but in some of them there is a constant flow of water.

Eight of the largest of these gullies are from 500 to 1,100 feet wide at the top, sloping to about 6 feet wide at the bottom, and from 100 to 260 feet in depth.

About a mile of the line on the banks of the river is on clay slides, continually shifting from the action of the river at their feet: these would require substantial works to protect them.

On the next 12 miles, through the marble canyon, the grades are generally easy and undulating, the highest being 55 feet per mile for a mile and a half. The highest point on the line through the canyon is 2,865 feet above sea level.

The works through this length will be medium; there are no deep cuttings, but what there are will be in rock.

Thence down the Hat Creek Valley to its junction with that of the Bonaparte, a distance of about 12 miles, the line is on a continually descending grade, averaging 1 per 100 with few variations, the highest grade being 2 per 100 for a mile, and the lowest 15 feet per mile for two and a half miles.

The works on this section will be very heavy, as the line is well up on the slopes of the valley, which are rock-ribbed and serrated, resembling those of the Fraser valley. There will be a number of rock cuttings varying from 500 to 1,500 feet in length, with a maximum depth of 30 to 70 feet.

There are also a number of deep lateral ravines to cross; six of these run from 90 to 180 feet in depth, 400 to 600 feet wide at the top, and tapering to about 6 feet at the bottom.

These works could be greatly reduced by keeping the line near the bottom of the valley, but the grades would be much steeper.

The last point is upon the western slope of the Bonaparte valley, about 500 feet above the bottom flat; the line follows on the slopes of this valley, with falling grades varying very little from 1 per 100 for 6½ miles, where it reaches the bottom of the valley, near the 124th mile, on the waggon road to Clinton.

The works on this portion will be lighter than on any of the preceding sections from Lillooet, for though the line is still on rock, covered with a few inches of soil, there are no deep cuttings or lateral ravines.

The last point is 1,832 feet above sea level, and thence 24 miles up the valley the grades are tolerably uniform at the rate of 31 feet per mile; the only variations being one grade of 73 feet per mile for two and a half miles, and a few short lengths of 53 feet per mile.

The works throughout this length will be light; for though the slopes of the valley are rock, with a thin covering of soil, the line can be kept close to the bottom flat, avoiding any deep cutting.

From this the rocky slopes of the valley close in on the river, forming a canyon a mile and a half in length, the grade through which is 1.75 per 100 or 92½ feet per mile; but the slopes near the river are not steep, and the work through the canyon will not be heavy.

The elevation at the head of the canyon is 2,717 feet above sea level, and from this, for 12 miles up the river, the rise is very gradual, averaging 26½ feet per mile, with light work.

Thence for three miles and a quarter, to the head waters of the Bonaparte, the rise is at the rate of 2 per 100 through a narrow valley with much loose rock on its slopes: in this the work will be rather heavy.

We have now reached an altitude of 3,372 feet above sea level, in a broad open basin or depression in the great central plateau of British Columbia. The Bonaparte river flowing gently through a chain of small lakes or beaver dams. The rise in the next 12 miles is only 122 feet, and the work will be very light.

From this to the divide or watershed between the Bonaparte and Thompson rivers, a distance of 14 miles, the rise is 366 feet, the altitude of the summit being 3,860 feet; the grades on this are generally easy, with two exceptions, one being 92 feet for one mile, and the other 95 feet for the same distance. The works on the whole 14 miles will be light.

On the summit there is half a mile of level, then a descending grade of 2 per 100 for nearly a mile and a half, in which there will be a side hill cutting through loose rock 2,300 feet long, and averaging 30 feet in depth.

For the next 10 miles the line runs along the shores of Lac-des-Roches and two other small lakes, with easy, undulating grades, and the works will be light or medium.

From the Fraser river to this point we have been crossing an undulating or broken country; the thin coating of soil, which covers the rocks, maintaining a luxuriant growth of bunch grass and wormwood, and thinly dotted with fir trees. But now we are entering on the slopes which descend to the valley of the North Thompson, and both the quantity and size of the timber are greatly increased.

The point at the outlet of the lakes last alluded to is 3,707 feet above sea level, at the head of a deep ravine through which the stream that carries off their surplus waters flows into the North Thompson river.

The line follows the slopes or benches on the east side of this ravine, nearly 14 miles, with a continuous falling grade of 2 per 100, crossing five rocky spurs, averaging 750 feet in length, that will have to be tunnelled; the rest of the work will be light.

From this the line deflects to the northward, descending obliquely the western slope of the Thompson valley till it reaches the bottom; and crossing the river, joins the line surveyed in 1872, about six miles below the mouth of the Clearwater.

In this last length of 12 miles, the grade continues to fall at the rate of 2 per 100 for nearly 9 miles, with only one break of a quarter of a mile of level; making, altogether, a nearly continuous grade of 106 feet per mile for 23 miles.

The western slope of the Thompson valley is here very irregular and broken with deep lateral ravines and rocky spurs shooting down to near the bottom of the valley, and the work will consequently be heavy, requiring on the line surveyed two tunnels, one 4,300 feet and the other 8,300 feet in length.

But it has been ascertained from explorations made subsequent to the survey, that the long, steep grade of 2 per 100, and probably all or most of the tunnelling can be avoided by carrying the line farther up the slopes and on to the higher benches, which would give a falling grade of about 80 feet per mile for 30 miles in length; this would carry the line above the mouth of the Clearwater river before the bottom of the valley was reached; it would then cross that river and join the line surveyed in 1872, near to where that to Bute Inlet branches off, on the right or west bank of the Thompson river, and thus avoid crossing the latter.

The distance from Lillooet to Clearwater junction by the line surveyed is 168 miles; on nearly one-half of this distance the work would be light; on one-fourth medium, and on the balance heavy work, principally in rock cutting.

On the whole, the line by this route is not satisfactory. There are four summits or watersheds to pass over, requiring long, steep grades, alternately rising and falling; and a very large proportion of the works would be heavy rock cuttings.

RESULTS OF THE SURVEYS IN THE ROCKY MOUNTAIN ZONE.

To the end of the Year 1873.

The surveys made up to the present time through the great mountain zone running parallel to the shores of the Pacific Ocean, shew that a favorable line for the railway can be obtained from the summit of the Yellow Head Pass in the Rocky Mountains eastward to Fort Edmonton on the North Saskatchewan River.

The distance between these two points is estimated at 288 miles, and on the first 50 miles from the summit of the pass easterly there will be a considerable number of rock cuttings, but none of them very deep, and but very little, if any, tunnelling will be required. The grades throughout this length will be easy.

Thence across the foot hills to Fort Edmonton the grades will be undulating, and none of them need exceed 53 feet per mile; with excavations of no great depth, in sand and clay loam, and only a few cuttings through soft sandstone. The most important works on this section will be the bridging of the Athabasca, McLeod, Pembina and Saskatchewan Rivers.

Westward of the Yellow Head Pass that portion of the line between Moose and Cranberry Lakes has been re-surveyed with satisfactory results, as the works, though heavy on some part of the distance will be lighter than anticipated, and the ascent to the summit will be overcome by a general gradient of 35 feet per mile.

The whole of the line from Fort Edmonton to the Yellow Head Pass, thence to the junction of the two branches of the Thompson River, near Kamloops, a distance 538 miles may now be considered satisfactory.

From different points on the western portion of this line, four distinct lines have been surveyed through the Cascade Mountain to the Pacific Coast; two of these terminate at Burrard Inlet near New Westminster; one at the head of Howe Sound, about 30 miles further north, and the other at the head of Bute Inlet about 120 miles to the northwest o the latter point.

On all these lines there are difficulties of a very grave character, and from the experience gained there is not much hope of finding a line without excessively heavy works on some part of its course through the Cascade Chain of mountains involving a considerable proportion of tunnelling

On some of the lines, however, these tunnels, as far as can be judged at present, will be of the simplest description, offering the greatest facilities for rapid execution. They occur in a great number of short lengths varying from 200 to 2,000 feet, through spurs of solid rock, so that n lining with masonry will be required; it is not expected there will be any water to contend with, and the distance to haul the materials excavated will be very short.*

These tunnels could be commenced at a great number of faces at once so that the completion of the railway would not be unduly delayed, as would be the case if the tunnelling were all in one length of four to five miles.

It is through the Cascade, or the coast chain of mountains that the greatest engineering difficulties have still to be overcome; and it is obvious that the best line that can be found through this chain, both as regards the cost of construction and the working expenses afterwards, should, to a large extent, govern the selection of the terminus on the Pacific coast and a considerable portion of the route eastward, therefore the following brief description of the principal features of the several lines surveyed through this chain may be of service.

Route No. 1.—*From Fort Edmonton to Burrard Inlet, on the Pacific Coast (via the Yellowhead Pass, North Thompson, Coquihalla and Lower Fraser Valleys.)*

The total length of this line is 754 miles, and that part of it from Edmonton to the Clearwater Junction with the North Thompson valley, a distance of 468 miles, is common to all the lines surveyed through the Cascade chain, and has been described as favorable.

It will be from this point that the comparison of the features of these several lines will commence, but the distances are given from Edmonton as future surveys that will have to be compared, may commence further eastward than Clearwater.

From Clearwater to the junction of the two branches of the Thompson the line is generally favorable with but a small proportion of heav work, including 500 feet of tunnelling.

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* A map of the country from the Pacific Ocean across the Mountain Zone eastward to the 112th degr west longitude, shewing the several routes surveyed for the railway is herewith attached; also, diagram shewing the distances and heights of prominent points on these routes.

But from this point to Fort Hope, via Nicola Lake and the Coquihalla Valley, a distance of 131 miles, there are two summits to pass over, one 2,900 feet and the other 3,520 feet above sea level, and as the points at either end of this distance are respectively 1,170 feet and 127 feet above sea level, there must necessarily be great lengths of very steep grades, some of which may be considered impracticable ; one of these rises at the rate of 172 feet per mile for 7 miles, part of it through a continuous tunnel about 3¾ miles in length.

From Fort Hope down the Fraser valley, the line is more favorable, though there would be some very heavy work on the first 30 miles, embracing the bridging of the Fraser and Harrison rivers.

On the whole this line is far from favorable both on account of the grades, and *excessively* heavy work ; of the latter it is estimated there would be about 40 miles, including an aggregate of 6 to 7 miles of tunnelling.

Route No. 2.—From Fort Edmonton to Burrard Inlet on the Pacific Coast, (via the Yellowhead Pass, Thompson and Fraser River Valleys.)

The total length of this line is 790 miles ; it branches out of the first line at the junction of the two branches of the Thompson near Kamloops, and follows the natural outlet to the Pacific by the Thompson and Fraser rivers to New Westminister, and thence across a narrow neck of land to Burrard Inlet.

This line affords the best possible grades that can be obtained from the Yellowhead Pass to the Pacific Coast, while the Harbors of Burrard Inlet and the outer basin of English Bay are undoubtedly superior to any other on the mainland coast of British Columbia for a railway terminus, both as regards their position for commerce, the rich agricultural country in their vicinity, and the facilities on their shores for the construction of wharves, and the various works required for a railway depot. But from the bluffs on Kamloops lake to a point on the lower Fraser, below Harrison River, a distance of 170 miles, there would be a large amount of very heavy works with a very small proportion of light work.

The survey of the Fraser Valley made in 1871 is very imperfect, the line having been run on the waggon road from Yale to Lytton, where it is altogether impracticable for railway construction, and with no continuous levels taken even on that, so that the plans do not afford the information necessary for so close a description of the works as I have given on the other lines.

But from a careful examination with the eye, in travelling up and down several times, I am enabled to state generally that the works will consist of a large amount of bridging over deep lateral ravines, several miles of heavy protection works along the river to support shifting slopes of gravel, sand, clay or loose rocks, and a very large quantity of rock excavation.

The proportion of *excessively* heavy work is estimated to extend over 57 miles including an aggregate of 7 to 8 miles of tunnelling. I do not think it probable that a better survey would materially alter this estimate.

Route No. 3.—From Fort Edmonton to Howe Sound, on the Pacific Coast, (via Yellowhead Pass, the North Thompson and Bonaparte Valleys, the marble canyon and a chain of openings through the Cascade Mountains.)

The total length of this line is 752 miles; it branches out of the first line near Clearwater, in the Thompson Valley, and it is probably the shortest practicable line for a railway from Fort Edmonton to any harbour on the Pacific Coast within the Province of British Columbia.

But, between Clearwater and the coast there are four summits to pass over, with very low depressions between each, so that the grades throughout a large portion of the line are generally very objectionable, there being fully 100 miles on which they reach from 80 to 105 feet per mile, alternately rising and descending on the long slopes of the dividing ranges.

The proportionate length in which heavy rock cuttings occur is also very great, being 160 out of 284 miles, from Clearwater to Howe Sound, and of this about 70 miles is *excessively heavy* work, embracing a great number of short tunnels, which could scarcely be reduced to less than an aggregate of 7 miles in length. So that though this is the shortest line, it is not probable that the cost of constructing it would be the least.

Route No. 4.—From Fort Edmonton to Bute Inlet, on the Pacific Coast (via. Yellowhead Pass, the North Thompson, Lac la Hache and Homathco Valleys.)

The total length of this line is 846 miles; it leaves the first line a little above the forks of the North Thompson and Clearwater rivers, and takes a northwesterly course, as described in detail in my report of the surveys of 1872.

From Clearwater to the Pacific coast the line passes over three summits, the altitudes of which are 3,104 feet, 3,700 feet, and 3,117 feet respectively above sea level; and as the altitudes of the Thompson and Fraser valleys are each about 1,400 feet, there will, unavoidably, be a considerable length of unfavorable grades, alternately rising and falling.

On the first 35 miles both the grades and curves are objectionable, and on a large proportion of this length the works would be *excessively* heavy, both in bridging and rock excavation, and there would be probably a mile and a half of tunnelling.

There would also be some unfavourable grades and a considerable length of very heavy work on the west side of the Fraser Valley, in rising to the great central plateau, west of the Fraser, known as the Chilcoten Plains.

But it is expected that a great proportion of the objectionable part of the line up to this point can be avoided, and the line shortened fully 40 miles by leaving the Thompson Valley about 70 miles further up, and following that of Blue River and the Pass westward to the Clearwater.

An exploration was made last autumn from Lac La Hache northeasterly to the Clearwater River, striking it about 9 miles north of the line surveyed in 1872, at a point opposite the Pass leading to the Blue River; so far, the line was satisfactory, but unfortunately owing to the lateness of season the explorations could not then be extended to the Thompson Valley; it is however so important, that it should be done as early as possible next spring.

From the Fraser Valley to the water shed at the head of the Homathco valley or pass, a distance of 123 miles the works will be generally light or medium, but with grades on the first 13 miles rising from 60 to 95 feet per mile.

The features that mainly distinguish this route are found in its course from this point through the Cascade Mountains. The length is 87 miles, and of this 55 miles must be classed as light and medium work. in about equal proportions; the former occurring where the line runs on the bottom flats of the valley and the latter where it runs on mountain slopes of easy inclination and tolerably uniform outline.

Of the balance of 32 miles 17 miles must be classed as heavy, as the line runs partly on slopes broken by lateral ravines and rocky spurs; the latter will require several short tunnels, making together a length of 3500 feet. The *excessively* heavy works will all be concentrated on 15 miles through the great canyon, with a continuous grade of 110 feet per mile. These works will embrace bridging over deep chasms, very heavy rock excavations and a great number of short tunnels, making and aggregate length of about 3 miles. The aggregate length of tunnelling on this route through the Cascade Mountains is estimated at 4 miles.

In order to complete the work of exploration so as to gain the information which appears necessary to admit of an intelligent decision on the question of route through British Columbia the following surveys are suggested:

First—A line should be surveyed from the valley of the North Thompson up that of Blue river, thence across to the Fraser river by the route partly explored last autumn.

Second—The survey should be continued across the Fraser and the Chilcotin Plains with the object of avoiding or reducing the heaviest portions of the works on the line surveyed in 1872.

Every exertion should be made to perfect this line as it promises to be the most direct practicable route between Yellowhead Pass and Bute Inlet.

It will also, to a great extent, avoid the deep snow belt that extends along the southwestern slopes of the Rocky Mountains and to a considerable distance on to the central plateau between those and the Cascade chain; and it will afford facilities for communication with both the northern and southern districts of British Columbia.

The expected results of these surveys are shewn by the dotted lines on diagram of *Route No.* 5 accompanying this Report.

Third. Should this line not prove satisfactory, and it be deemed advisable to try a route farther north, then a survey should be made on a line as direct as practicable, from Tatla Lake to the Giscome Portage at the great bend of the Fraser above Fort George.

This line would be the common approach to all the passes through the Rocky Mountains between Yellowhead and Peace river.

We have reliable information which leaves no doubt that a favorable line can be obtained from the Giscome Portage, following up the valley of this improvement the construction of about 10 miles of a branch line will effect the same object.

Two parties are still in the field surveying a line about midway between our surveys of 1871-2, west of the "Height of Land," and connec ing the branch line to Thunder Bay with the main line.

It is expected that this portion of the survey will be completed earl in the coming spring; from information already received, in reference the country under examination, no material difficulty is anticipated, and is believed that a very direct and favorable line will be found betwee Lake Superior and Red River.

The foregoing is a brief outline of the work in progress and complete during the past season. Everything connected with the work was carrie out in a very satisfactory manner: the staff, both engineering and commi sariat, fulfilling their respective duties with energy and success.

The transport of supplies through an unexplored country, when th only means of carrying them is either men's backs or birch bark canoes, of a peculiar character, requiring great energy, and involving much har ship and exposure to those engaged in it.

I regret having to report that the list of those who have lost the lives, while employed on this work, has been increased by six name having, however, made a special report to you on this subject, I shall n now further allude to it.

As the late fire destroyed the most of our field notes, plans, section &c., it may be well that I should give, while details are still fresh in m memory, some particulars of the work performed in this district, togethe with a few general remarks bearing on the future progress of the Railwa survey and construction.

When this work was commenced, in June 1871, but little was know of the country extending from the Ottawa River to the Province of Man toba, further than the generally received impression that a portion of lying to the north of Lake Superior, was so rugged as to render doubtf the fact whether a practicable route for a Railway could be found.

At that time a line for exploration was determined on, which, from th information collected, was thought would prove practicable and direc between the junction of the Ottawa and Mattawa Rivers and Fort Gar in the Province of Manitoba. The first point being selected as one wi which the existing railways, in Ontario and Quebec, could be easi connected.

From the above-named point the exploration was made, on the we bank of the Ottawa to the Montreal river, and along its northern bank the "Great Bend"; from this point a direction, a little to the north of wes was followed to the southern end of Long Lake, where the course wa changed to the southward, with a view to forming a connection with th waters of Lake Superior at Nepigon Bay; from this point it was continu north of the Lake of the Woods to Red River; the total distance bein close on 1,000 miles.

Having, from personal examination as well as from the informati obtained from the various engineering parties, arrived at a tolerably co rect knowledge of this region, I shall proceed to describe it more in deta

It may, for purposes of description, be subdivided into four parts, as follows:

1st. The Winnipeg Division: length about 350 miles.
2nd. The Nepigon Division: length about 200 miles.
3rd. The Moose Division: length about 350 miles.
4th. The Nipissing Division: length about 100 miles.

Winnipeg Division.

Of this subdivision, the general characteristics are, for the 80 miles immediately east of Red River, a level and in some parts swampy country, with ridges of sand and gravel more or less thickly covered with timber; the next 70 miles is rough, broken and rocky, especially in the neighborhood of Winnipeg River, which at the outlet of the Lake of the Woods, (Rat Portage) where we cross it, is a stream of considerable magnitude, draining an area of country of about 10,000 square miles; an area which is largely increased below the point where we cross it, as will be explained subsequently.

The Winnipeg River, from its source at the Lake of the Woods to its outlet at Lake Winnipeg, flows generally in a direction at right angles to the strike of the rocks; throughout its course it is much broken by islands and rapids, having a total fall of about 320 feet.

Rat Portage, or the Dalles a few miles further down, are the two most favorable points for a railway crossing.

The country from this point to the "Height of Land" or eastern boundary of this subdivision, has a gradual ascent, the total rise being between 400 and 500 feet in a distance of 230 miles. There are some peculiarities in this section which require particular notice.

The first is the great extent of water surface covering it, consisting of lakes and lacustrine streams of every conceivable shape and size; the former, for the most part, lying in the direction of the strike of the rocks; the latter occasionally cutting across it.

The hills which almost universally follow a general direction from N.E. to S.W., consist for the most part of rock ot the Laurentian formation.

There are evident indications that from time to time the whole of this country had been swept by fire; the wood with which it is covered, except where more recent fires have cleared it away, being such as to lead to this conclusion.

Lastly there is a peculiarity which has an important bearing on the location of a railway; it is that about 30 miles east of Rat Portage a "divide" is crossed, which has a course generally easterly until it strikes the "Height of Land" above referred to. This "divide," which has at some points a greater elevation than the "Height of Land," throws some of the waters, which flow through the Winnipeg River, to the south; forming the line of water communication known as the "Dawson Route."

From the northern slope of the "divide" the waters flow into English River, the outfall of Lonely Lake or Lac Seul, and enter the Winnipeg fifty miles below Rat Portage.

The country differs greatly on either side of this "divide," that on the south being extremely rocky and rugged, while that on the north is more level with extensive tracts of light sandy soil.

Three rivers of considerable volume are crossed on this length.

Nepigon Division.

The next sub-division lies, for the most part, within the basin of Lake Nepigon. The descent from the "Height of Land," to this body of water, being much more rapid than the ascent on its western side, falling some 900 feet in a distance of about 50 miles ; lakes are consequently much less numerous, and the character of the hills is completely changed, being more detached, very precipitous on their northern and western sides and standing at a greater altitude above the general level of the country.

Their direction is also changed, inclining from north and south to north west and south east; the rock of which they are formed being generally granite or trap.

The centre of this sub-division is intersected, at its northern end, by Lake Nepigon, (a body of water some 70 miles long by 50 miles wide, full of islands) and at its southern end by the valleys of the Black Sturgeon and Nepigon, rivers of considerable size and volume. In their valleys are considerable tracts of good land and timber of fair quality ; consisting of spruce, tamarac, cedar, pitch pine and a sprinkling of white and red pine.

After passing these waters the country towards the east, still maintaining the same character, rises rapidly until the "Height of Land" is again crossed in the neighborhood of Long Lake.

There is in this part of the country a "divide" somewhat similar to that described in the neighborhood of Rat Portage. In this case it runs east from the southern end of Nepigon Lake, and divides the waters flowing south into Lake Superior from those which flow northward, but ultimately find their way to the same place through the valley of the Nepigon.

To the south of this line the country is extremely rough, rocky, and mountainous, cut through by the valleys of rivers running from north to south having their sources in the "Height of Land." On each side of these rivers the hills rise from the water's edge, steep and precipitous to a height of from 400 to 600 feet near Lake Superior. They are almost without a break from this point northward, until they run out in the level of the "Height of Land."

As frequent reference has already been made to the "Height of Land." and as it becomes a very important feature of that portion of the country yet to be described, this would seem to be an appropriate place to introduce a few remarks in reference to it.

The "Height of Land," (or "divide" between the waters which flow into the Atlantic Ocean through the St. Lawrence River and those tha empty into Hudson's Bay,) from a point near the "great bend" of th Montreal River, to where it passes into the territory of the United State west of Pigeon River, is of a uniform elevation varying from 1400 to 150 feet above the level of the sea. Although throughout its course ver tortuous, its general direction may be described as follows :—

From the first point named it follows a southern course until withi between 50 and 60 miles of the North shore of the Georgian Bay, from thence and at this distance, it continues parallel to that coast and the East and North coast of Lake Superior, until north of Michipicoten Island it makes a great deflection to the south-west; and passing round the southern end of Long Lake, approaches within 20 miles of Lake Superior, north of the Slate Islands; thence, turning to the north and west it curves round the head of Lake Nepigon at a distance of 20 miles, and from there it passes, 50 miles west of that lake and Lake Superior, in a south-westerly direction until it crosses the boundary between the Dominion of Canada and the United States.

It is not a mountain range but merely an elevated plateau, and one remarkable peculiarity connected with it is the number of lakes which occupy its summit, whose waters could easily be diverted and made to flow either to one side or the other.

Moose Division.

In speaking of the third sub-division, extending from Long Lake to the Ottawa river, it will be necessary to divide it into two sections—a northern and southern—the dividing line being the height of land as far east as the great bend of the Montreal river, and the Montreal river itself from that point to the Ottawa.

The southern section, along Lakes Superior and Huron, is throughout very similar in character to that described at the south-eastern end of the last sub-division.

In many places the lofty hills of granite, have been swept bare of every trace of vegetation by fire, and present a most formidable and forbidding aspect.

The northern section is in marked contrast to all this; when the "Height of Land" is passed and you proceed a short distance to the north of it, the country is generally level and in some parts swampy, the latter being no doubt caused, to a great extent, by the dense growth of timber which covers it,—fires having been much less frequent in this section.

Owing to the dense growth of timber and there being no exceptionally high hills, from which an extended view of the country can be obtained, it is impossible to form a correct opinion as to whether much of this country could be rendered available for settlement.

At many points, even south of the "Height of Land," there are tracts of very fair land, and there can be little doubt that were this country cleared and drained, the effect upon the soil and climate would be as marked as it has been in the settled parts of Canada.

Nipissing Division.

The greater part of this division, is very similar in character to the eastern half of the Winnipeg division already described; in the neighbourhood of Lake Nipissing, however, it is much more favourable, and there are some tracts of good land and hardwood timber.

GENERAL REMARKS.—(See sheet No. 10.)

In the original line of exploration the "Height of Land" was crosse
five times, first, about 15 miles west of the Great Bend (Montreal River
second, about 180 miles further west; third, on the east; and fourth,
the west side of Long Lake; fifth and lastly, about 50 miles west of La
Nepigon.

The character of the country is very similar in the neighbourhood
either side of this elevated plateau, but outside that margin, the differen
as regards its adaptability for railway construction is very marked; f
while to the south it is broken up by hills of considerable altitude, wi
lakes intervening, of all shapes, sizes, and some of great depth, to the nor
it is comparatively level and swampy.

The greater portion of the country explored is covered with a den
growth of moderate sized timber, consisting of balsam, spruce, popla
white birch, some tamarac, and occasional groves of white, but principall
red pine; while at many points there are indications of valuable miner
deposits.*

The result of the survey along the line as above described proves th
while a practicable line can be obtained from the starting point to th
second crossing of the "Height of Land," from thence eastward to the fift
crossing was, if not entirely impracticable, extremely unfavorable; but i
was ascertained, at the same time, that by keeping north of the "Height
Land," most of the difficulties encountered on the line surveyed might b
avoided.

This led to the exploration of a line, which, starting some miles
the east of the second crossing of the "Height of Land," passing north
Lake Nepigon and thence to Red River; having a branch line connecti
it with the waters of Lake Superior either at Thunder or Nepigon Bay

This line and the branches proved quite practicable throughout; b
as it involved the construction of a considerable length of branch li
about 150 miles to Thunder or 110 miles to Nepigon Bay, it was consider
desirable to make a further and more thorough examination and surve
of the country in the neighborhood of Lake Nepigon on its east, south a
west sides.

It was also considered advisable that a further examination should
made of the country at the eastern end of the district, with a view of asc
taining whether an alternative or more favorable line could be obtain
south of that previously surveyed.

The result of these surveys has been satisfactory, shewing in the latt
case that a more direct line, with lighter work, can be construct
from the southeast shore of Lake Nipissing up the valley of the Sturge
River to a point, on the line previously surveyed, west of the east bran
of Moose River. While in the former case it is proved that a good prac
cable line can be obtained south of Lake Nepigon, which may be connect
with the waters of Lake Superior at either Thunder or Nepigon Bay; a
being carried from the latter point, north eastward to the north end of Lo

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* Iron, copper, lead, and gypsum in large quantities; silver also has been found; and the Indians
here is coal or lignite, which statement is borne out, to some extent, by a remark of Mr. Bell's in
geological report on the Albany River.

Lake, will there connect with the favorable line before mentioned, thus avoiding the rough and impracticable country lying between the "Height of Land" and the north shore of Lake Superior, through which the line of 1871-2 was run.

As already stated the distance between Red River and Lake Nipissing is about 1,000 miles, but in order to find a practicable line for the railway between these points, and at the same time to connect it with the waters of Lake Superior, it has been found necessary to survey about 2,500 miles of line, and in addition a large amount of exploration.

It thus appears that three practicable routes have been discovered. On either of these the railway can be constructed with the following results as regards distances:—

Route No. 1.—Via North of Lake Nepigon.

FROM.	TO LAKE SUPERIOR.		TO MATTAWA.	Total length of Main Line and Branch.
	VIA NEPIGON.	VIA THUNDER BAY.		
Red River.	Main Line.... 325 } miles Branch .... 110 } 435	Main Line.... 288 } miles Branch .... 150 } 438	Miles Main Line.. 982	1,132 miles.

Route No. 2.—Via Nepigon Bay.

From	To LAKE SUPERIOR.	To LAKE NIPISSING.	Total Length.	Remarks.
Red River.	Miles Nepigon River.... 416	Miles South East Bay.... 973	Miles 973	No Branch Line required.

Route No. 3.—Via Thunder Bay.

From	To LAKE SUPERIOR.	To LAKE NIPISSING.	Total Length.	Remarks.
Red River.	Miles Kaministiquia River 398	Miles South East Bay.... 1,037	Miles 1,037	No Branch Line required.

NOTE:—The distance from Red River to Lake Manitoba is estimated at 65 miles.

If the contemplated improvements, to either Nepigon or Kaministiquia Rivers, are not carried out, the length of line between Red River and Lake Superior would be increased between 8 and 10 miles.

The features of the country lying between Red River and Lake Superior are now so well known, that further explorations would seem to be unnecessary, and the location survey may be commenced so soon as the general line to be followed is determined; there can be no doubt, however, but that further exploration on the eastern portion of the Distric would lead to further improvement on the line.

The general character of the work on all these routes would be very similar:—*Route No.* 1 may have some slight advantage as regards gradients, but this would be more than counterbalanced by the additional length of line to be constructed and maintained.

The principal physical difficulties to be contended with in the construction of the Railway, throughout the whole section of the country unsideration, are the great extent of water encountered on the route, its rocky character and inaccessibility. It is nevertheless believed that, a very direct line can be obtained, the quantities of excavation and embankment not exceeding the average of railways already constructed in other parts of the Dominion. The last difficulty can be overcome to a considerable extent, by means of the knowledge of the country already obtained.

There are not many large rivers to be crossed on the line as proposed, and of these, not more than three or four which will require bridges of 200 feet span. Timber of good quality and in sufficient quantity for the various purpose of the railway, can be obtained either upon the line or in its neighborhood.

The gradients will be favourable, in no case exceeding 1 foot per 100 or 52·80 feet per mile; and of this maximum gradient, the percentage will be small. The destruction by the late fire of most of the profiles, prevents my giving greater detail under this head; but, the accompanying "Profile of General Gradients," (see sheet No. 9) compiled from data still in my possession, will give a correct idea of the country traversed.

SNOW FALL.

The question of snow-fall is a subject of great importance when taken in connection with this work. Few, if any, reliable facts in connection with it, as regards the country now under consideration, have been hitherto known; the following from observations made by our own parties will throw some light on the subject. Commencing at Ottawa, where the average depth in winter may be taken as about from 3 ft. 6 in. to 4 ft, it decreases gradually as we proceed westerly; in the neighborhood of the Great Bend of the Montreal River, it is 3 ft. 6 in.; on the height of land, north of Michipicoten on Lake Superior, it is 2 ft. 8 in.; west of Lake Nepigon, it is 2 ft. 3 in.; and at Red River, from 2 ft. to 1 ft. 6 in. Near the shore of Lake Superior, the depth will average between 3 ft. and 4 ft.

There is a marked difference, however, between the character of the snow which falls throughout the whole of the country to the west of the Montreal River and that which falls east of that longitude. In the former country there are no thaws during the winter, the snow is consequently dry and light, and *never packs*; while in the latter, on the contrary, frequent thaws cause it to pack, as in the settled portions of the country to the south. This is one great source of difficulty, experienced in removing it from the track of a railway.

On the shore of Lake Superior the thermometer will indicate, once or twice during the winter, from 39° to 42° below zero; in the interior, however, it seldom, if ever, falls as low as this. In summer, during the day time, in the months of July and August, the heat is as great as in this part of Canada, but the nights are always cool.

When once spring commences, vegetation is very rapid; the ice and snow have hardly disappeared before the trees are in full leaf.

While on the subject of climate, I may mention that Mr. Crawford, the H. B. Coy's. officer at Red Rock, cleared about 15 acres of land last spring on which he raised some very fine barley, oats, potatoes, and turnips; in his garden were peas, beans, carrots, cabbage, and a few heads of Indian corn. He informed me that when he lived at Nepigon Lake he had raised tomatoes in the open air.

HARBOURS ON LAKE SUPERIOR.

The relative merits, as regards the Railway, of Thunder and Nepigon Bay for a terminal station, on Lake Superior, have been already stated; but there is another point in reference to them which requires to be taken into consideration, namely, their respective advantages as Harbours.

Owing to peculiar circumstances, such as the important Post of the Hudson's Bay Company (Fort William) and one terminus of the "Dawson Route" to Red River, &c., being situated on the shores of Thunder Bay, it has been much frequented for years, and settlements have been established in its neighborhood; its advantages are consequently well known, and it has many interested advocates.

Nepigon Bay, on the contrary, was comparatively unknown and unfrequented until the commencement of this survey in 1871. It, therefore, has few advocates, although the Railway surveys have demonstrated the the fact, that there are in its neighborhood and in the valley of the Black Sturgeon River, extensive tracts of land of as good quality as are to be found in the vicinity of Thunder Bay; and, during the past summer, mining has been carried on to some extent in the neighborhood.

In addition, therefore, to pointing out the advantages likely to accrue by opening up this, hitherto unknown, part of the country; it is most desirable that all the known advantages and disadvantages of both bays, should be clearly and fairly stated, with the view of enabling a decision to be arrived at, as to which point the terminus shall be placed.

It will simplify the consideration of the subject, to examine each bay separately, and to divide it into these heads, viz:—

1st. General description.
2nd. Depth of water and direction of channel.
3rd. Ice.
4th. Fog.

The 2nd of these is said to have an important bearing on the 3rd and 4th.

With the view of making what follows more inteligible, a copy of Admiral Bayfield's chart of both Bays is herewith submitted, the correctness of that of Nepigon has been verified by our surveys.

The course usually followed by steamboats is shewn by a dotted line thus . . . .

THUNDER BAY. (See sheet No. 13.)

1st. General Description.

This bay is on the north-west shore of Lake Superior, and has an area of about 200 square miles. It lies in a direction generally from north-east to south-west, and is bound, on the west and north, by the main land; on the east by the promontory of Thunder Cape, which divides it from Black Bay; and on the south it is divided from Lake Superior by a number of islands, of which Pie Island is the principal.

Outside these islands at a distance of about 14 miles to the south-east is Isle Royale, which is about 45 miles long and from 7 to 8 wide; this island belongs to the United States.

With the exception of a small group, (the Welcome Islands,) which lie about four miles east from the mouth of the Kaministiquia River, there are not many islands in Thunder Bay.

2nd. Depth of Water and Direction of Channel.

The principal entrance to Thunder Bay, and the one generally used, lies between Thunder Cape and Pie Island; it is about five miles wide and has a depth of water ranging from 100 feet to 237 feet. The general depth of the bay is given on the chart as 60 feet.

The course from the entrance to Prince Arthur's Landing is direct; from the same point to the Kaministiquia River a slight detour has to be made in order to clear the Welcome Islands. The navigation is good for either steamboats or sailng vessels; but, in the event of a gale from the south-east, the lee of the above-named islands is the only point in the bay where shelter can be obtained.

The great width of the entrance to the bay and its exposure to storms, having the full sweep of the lake, from the quarter just mentioned, would render it unsafe for vessels to attempt lying at Prince Arthur's Landing at such a time; indeed this place is exposed from north-east round to south-east, the nearest land (Thunder Cape,) being 14 miles distant.

There are, however, two means of meeting this difficulty which present themselves: either the construction of a breakwater to protect the works at P. A. Landing, or converting the Kaministiquia river into a harbour. The former would be a costly undertaking, and if the latter were adopted it would be necessary to dredge out the bar which has formed at its mouth. Some expense has already been incurred on this work, but it would require a further considerable outlay, before the channel would be wide and deep enough to admit large vessels, of the class now in use upon the lake; even then, sailing vessels would have to be towed in and out, and if it were considered desirable, in the interest of the railway, to carry the navigation any considerable distance up the river, this would be still more necessary, owing to its tortuous course. (See sheet No. 15.) It may be stated in connection with this subject, that considerable difficulty has been experienced at other points on Canadian lakes, in keeping the entrance to harbours formed in rivers free from deposits of earth, sand, &c.

3rd. Ice.

There is also the danger that if this point were selected for a harbour, it would be closed at an earlier date than Prince Arthur's Landing; my own experience leads me to form this opinion for, when I came from Nepigon to Thunder Bay, on my way to Ottawa, about the 6th of last November, although there was only a slight coating of ice round the shores of Nepigon River and Bay, and also round the shore of Thunder Bay, the ice on the Kaministiquia River was from 3 to 5 inches thick.

The fact of the entrance to Thunder Bay being exposed to gales, as before stated, is not altogether an unmixed evil, for they have a tendency to break up the ice in the bay, which, on a change of wind, will float out into the lake, thus accounting for its sometimes opening earlier, in spring, than at others. Still, on the other hand, the great width of the opening renders it probable that, on some occasions, after the bay is clear it may be again choked up by ice driven in from the lake by one of these gales. The average date for the Opening and Closing of the bay is about the 8th May and 30th December.

4th. Fogs.

There can be no doubt but that lake Superior, generally, is subject to fogs during the season of navigation. They occasionally come on very suddenly, and are much more frequent some years than others. During the summer of 1872 they were extremely prevalent. On one occasion I was on board the steamer when within about three miles of Michipicoten Island, the weather at the time being perfectly clear; in a very short time the fog became so dense that we were obliged to lie off the island for 36 hours. On another occasion the same thing occurred in the neighbourhood of Passage Island, near Thunder Bay, when I was on my way to the latter place. It is, however, a fortunate thing that fog and storm do not occur at the same time.

The danger and delay in reaching Thunder Bay arrising from this cause, would be much lessened by the erection of light-houses and fog-bells or steam whistles, on Passage Island and Thunder Cape; but, as the former belongs to the United States, there may be some difficulty in carrying out this suggestion.

The direct distance between Prince Arthur's Landing and the Sault Ste. Marie is 263 miles; this distance is slightly increased by the fact that the steamboats are obliged to call at Silver Islet with the mails, freight, etc., and would be still further increased if they call, from stress of weather, or to obtain a supply of wood, (of which there is abundance, maple,) at Michipicoten Island. For the course usually followed by steamboats see the dotted line on chart. (Sheet No. 13.)

NEPIGON BAY. (See sheet No. 14.)

1st. General Description.

This bay is situated to the north and east of Thunder Bay, and has an area of about 170 square miles. It lies in a direction generally from east to west, and is bounded on the west by a peninsula which divides i Black Bay; on the north, by the land forming the north shore of Superior; and on the south, it is divided from Lake Superior by a n of islands; the principal of these are, commencing at the west, Flu Ignace, Simpson, Salter and Wilson Islands.

The islands in the bay are not numerous; a group near the no end, which rise to a considerable altitude above the surface of the la crease the shelter at that point.

2nd. Depth of Water and Direction of Channel.

There are several navigable channels leading from the lake in bay, between the islands above named, but there are two which ar frequently used. One of these, called the Ste. Ignace channel, is situ the southwest angle of the bay, and divides Fluor and St. Ignace I from the peninsula of Black Bay, before referred to: this is the c followed by vessels passing between Nepigon, and Thunder Bay western end of Lake Superior.

The other channel, called the Simpson, is at the eastern end bay, and is situated between Simpson's and Salter's Island; this is t usually navigated by vessels passing between the Sault Ste. Mari Nepigon River.

Through both of these channels the large sized steamboats, which navigate Lake Superior, pass and re-pass constantly during the sea navigation.

It may be remarked here, and should be kept constantly in view, i nection with the general subject under consideration—1st. That t named channel lies almost in the direct line between the head of Nepig (one of the points where the railway may touch) and the Sault Ste. it is therefore the one through which all the freight and passenger between the east and west or *vice versa*, would pass—2nd. That we western channel (which parties refer to when they speak of, difficul gation for sailing vessels, early closing and late opening by ice, &c.,) altogether, it would not affect the bay as a harbor.

The Ste. Ignace Channel.

A vessel in entering the Ste. Ignace channel from Lake Su would have the mainland on her Port side, Fluor and Ste. Ignace i on the Starboard; these islands are covered with hills, some of indeed, deserving the name of mountains, being as lofty as any that be found round the shores of Lake Superior, rising in some instances the edge of the channel to a height of from 500 to 700 feet.

On the other side of the channel, the mainland, although not q mountainous is very rugged, but both on it and the islands the hil away, as the channel is passed through, until, when the bay is re they rise but little above the level of the lake.

The total length from the lake to the bay is 12½ miles; although perfectly straight channel, it cannot fairly be called a very crooke Throughout the greater part of its length this channel is at least mile wide; at no part is it less than ¼ of a mile wide, and in that width the least depth of water to be found is 15 feet, which is also the least depth of water which can be found anywhere within the widths named; indeed, with the exception of one point, the depth throughout greatly exceeds this figure, being at the lake end 96 feet and at the bay end 180 feet; a depth of 50 feet can be carried from this point the whole distance (16 miles) across the bay, in an almost straight course to Red Rock.

The Simpson Channel.

This channel, as already stated, lies in the direct course between the Sault Ste. Marie and Red Rock, at the mouth of the Nepigon river; it is bounded on the West by Simpson's Island and on the East by Salter's island. These islands have not as high land on them as Ste. Ignace, still their summits are several hundred feet above the surface of the lake.

The total length of this channel is 4½ miles; it is throughout over 1½ mile in width and perfectly straight; the depth of water at its outer end is 243 feet, and at its inner end 300 feet. From this point to the head of the bay, Red Rock, (35½ miles) the course is almost straight, leading past the islands La Verte and La Grange, excellent landmarks, which rise perpendicularly out of the water to a height of 700 or 800 feet. Throughout the whole of the above named distance the depth of the water varies from 50 feet to 80 feet, over a width and area ample for any class of navigation whether steam or sailing.

From Red Rock, where the Nepigon river flows into the bay, the river is at present navigated by the steamboats for a distance of two miles, up to the Hudson's Bay Post; (see sheet No. 15) the channel being 300 feet wide and from 14 feet to 30 feet deep. In this distance there is one curve which, owing to the current, requires to be passed with caution; this would be done away with by the improvement to be adverted presently. From the H. B. Post to Lake Ellen, a distance of three quarters of a mile, the river is at present unnavigable, owing to the crooked channel and swift current, although there is a good depth of water. Lake Ellen is 9 miles long, from half a mile to a mile in width, and from 25 feet to 100 feet deep.

In order to render the river easy of navigation between the Hudson Bay Post and Lake Ellen, the channel would have to be straightened and deepened. This would have the effect of lessening the current and extending the navigation 10 miles inland, to the head of Lake Ellen.

The difficulty experienced in preventing the formation of bars at the mouths of rivers converted into harbors, has been referred to already. These bars being formed by the deposite of material held in suspension in the river water and deposited at the point where the current ceases.

The position of Nepigon river is exceptionally favourable in this respect owing to the great depth of lake Ellen; this sheet of water, acting as a settling pond for the river, before it enters Nepigon bay; while, at the same time, the straightening of the channel would stop the scour from the banks below that lake.

In this river, as at the Kaministiquia, sailing vessels would have to be towed up and down; this, however, is already a necessity with ever sailing vessel which enters Lake Superior, as they have to be towed fro the head of Lake Huron to the foot of Lake Superior, through St. Mary' river, and canal.

The fact that propellers are fast becoming the almost universal mean of transport, in all our inland waters, tends to doing away with this difficulty altogether.

3rd.—Ice.

So little reliable information as to the exact dates of the opening an closing of Nepigon bay can be obtained, the destruction, by the burning o the office, of the original documents containing evidence on this subject i to be regretted. My recollection of the purport of this evidence is, tha the average date of opening of Nepigon Bay is the middle of May, an the average date of closing, the last week in December. I received a lette from Mr. Crawford a few days ago, dated the 4th Jan., in which he state that Nepigon Bay was not frozen over on the 3rd Jan.

The great depth of the eastern channel through the bay and th current of the Nepigon River, will probably account for its late closing while its well-sheltered position may account for its being somewhat late in opening than Thunder Bay.

Herewith is a table of the dates of the opening and closing of th Sault Ste. Marie River and Canal from the year 1843 to the year 187 This table shows that the average date of their opening is the 1st o May; and that the average date of closing is the 26th of November; whil the latest date on which they closed, during a period of thirty years, wa the 4th December in the year 1849.*

Therefore, although the canal opens, on an average, 14 days earlie it also closes from 15 to 20 days earlier than Nepigon Bay; so that i appears from these facts, the navigable season of Nepigon Bay is longe than the navigable season of the Sault Ste. Marie Canal. It also appear that both Nepigon and Thunder Bays remaining open after th date when the canal is closed, but there is no great advantage t either in this fact; as however Thunder Bay opens on an average a wee earlier than Nepigon Bay, and the canal opens earlier than either, Thunde Bay has an advantage of about a week over Nepigon Bay, in the lengt of its navigable season.

4th.—Fogs.

The general remarks, previously made, respecting fogs in connection with Thunder Bay apply here. Although I have been frequently i and out of Nepigon Bay, I have never been delayed by fog, nor do I thin they are more prevalent here than elsewhere on the lake.

That the steamboats have been delayed from this cause, and have no *entered* the bay, there can be no doubt. But as *the delays occurred durin the attempts to enter*, there is little doubt but that they would be entirel avoided if there was a good lighthouse and fog bell, or steam whistle, a the eastern entrance to the bay. Our own experience in connection wit this subject has been, that the fog may be quite thick on the lake outsid the islands, while the bay is comparatively clear.

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* See page 214.

The direct distance between Red Rock and the Sault Ste. Marie is 254 miles: and of this, 40 miles through the bay is completely sheltered, thus lessening the amount of the exposed navigation of the lake, the dangers of which are still further reduced, on this route, by the fact that the excellent and well-lighted harbour at Michipicoten Island lies in the direct course and about midway between the outlet of Nepigon Bay and the Sault Ste. Marie.

The routes usually followed by steamboats are shown on the chart by dotted line thus - - - - -

I cannot close this report without expressing my thanks to the gentlemen of the Staff, both Engineering and Commissiariat, for the energetic manner in which they have aided me to carry out your instructions.

As I have before stated, the unavoidable hardships and risks to life to which they have been exposed, can only be fully appreciated by one who, like myself, has experienced them.

We are also much indebted to all the officers of the Hudson's Bay Co., with whom we have been brought in contact, for valuable assistance and much personal kindness which they have rendered to us. Where this has been the rule it would seem almost invidious to particularize, but I cannot refrain from mentioning the names of Messrs. J. McIntire, of Fort William; R. Crawford, of Red Rock; and P. Bell of Michipicoten; in this connection.

I remain, Sir,
Yours truly,

JAMES H. ROWAN.

TABLE

Shewing the Opening and Closing dates of the

SAULT ST. MARIE RIVER AND CANAL.

Year.	OPENED.	CLOSED.
1843......	....	November 17
1844......	April.................. 22	" 28
1845......	" 21	" 9
1846......	" 16	" 25
1847......	May.................. 9	" 26
1848......	April.................. 26	" 28
1849......	May.................. 9	December 4
1850......	" 3	November 17
1851......	April.................. 23	" 27
1852......	May.................. 3	" 28
1853......	April.................. 28	" 27
1854......	" 28	" 29
1855......	May.................. 2	" 30
1856......	" 8	" 15
1857......	" 8	December 1
1858......	" 3	November 20
1859......	" 8	" 26
1860......	April.................. 25	" 29
1861......	May.................. 3	" 29
1862......	April.................. 27	December.......... 3
1863......	" 28	" 1
1864......	May.................. 2	November 26
1865......	" 1	December.......... 3
1866......	" 5	" 2
*1867......	....	....
1868......	May.................. 2	December 8
1869......	" 4	November 29
1870......	April.................. 29	December 1
1871......	May.................. 8	November 29
1872......	" 11	" 26
1873......	" 5	....

* The dates for this year have not been obtained.

APPENDIX K.

SPECIAL REPORT.

On the Passes through the Cascade and Rocky Mountain Chains, by
MARCUS SMITH, Esq.,

OTTAWA, June 2, 1873.

SANDFORD FLEMING. Esq.,
Chief Engineer C. P. R. Survey.

MY DEAR SIR.—Soon after my arrival in British Columbia last year I endeavored to get all the information possible about the several passes through the Cascade and Rocky Mountain chains, and in my letters I have furnished you from time to time such scraps of information as I could pick up. But in my report of the surveys and explorations of 1872 I have only alluded to these passes in a general way, as much of what I had learnt respecting them was necessarily vague and imperfect, having been obtained from the reports and conversation of persons having no scientific knowledge and who had travelled through the country for other objects. I have therefore thought it better not to mix up such information with that which has been obtained from actual survey or inspection, but to submit it in a special report.

PASSES THROUGH THE CASCADE MOUNTAINS.

The most southerly pass through the Cascade Mountains, from Fort Hope to Kamloops, via the Coquihalla and Coldwater Valleys, was surveyed early in the summer of 1872. The next in succession northwards, between the same points, via the Fraser and Thompson Rivers, had been surveyed the previous year; and immediately after my arrival in 1872, the survey of the Homathco Pass, from Bute Inlet, was commenced, and it was completed the same year.

Meanwhile, I had received information about another pass, from Howe Sound to Lillooet, which led me to believe it was worth a survey, especially as this route, lying between that of Fraser River and Bute Inlet, appeared on the map to be the most direct between Yellow Head Pass in the Rocky Mountains, and the Pacific Coast.

Farther north, about midway between Bute Inlet and the Skeena River, there are two more passes. The first of these—from the North Bentinck Arm to the central plateau, via the Bella Coula River—has been frequently travelled by traders and others, and in 1862 Lieutenant Palmer, R. E., made an exploratory survey of it, and his Report furnishes all the information necessary to form an opinion of that pass as a railway route.

The other pass—from Dean Channel to the central plateau, via the Dean or Salmon River—is a little farther north; of this I can get but little information. I think all reports concerning it must be conjectural, and derived from the vague statements of Indians, as I cannot learn that ever a white man has passed through that way. Sir Alexander McKenzie travelled in this section in 1793; he did not however follow the Dean River down to the sea, but crossed by a portage to the Bentick Arm. My own impression is that this pass will be found very little, if any, better than that by the Bella Coula, the sources of which and those of the Dean River are very near together and fully 4000 feet above the sea level, and the course of the latter to the sea cannot be so much longer than that of the former to materially alter the general grade, though it may possibly be more uniform throughout.

To endeavour to get from either the Dean or Gardner Channels to the Tazella Lakes, supposed to be the sources of the Nechaco River, appears even a more hopeless task, for these lakes cannot be much under 3000 feet above sea level, and may be much more; between these lakes and the Pacific the Cascade Mountains intervene, and we know of no opening through which this barrier can be crossed.

To set the question at rest, however, it may be expedient to send an exploring party to examine this region to see if there is a route feasible enough to justify the cost of a survey.

I have now referred to all the passes I have heard of through the Cascade Mountains, between the southern boundary line of British Columbia and the River Skeena, which I think worthy of consideration.

PASSES THROUGH THE ROCKY MOUNTAINS.

The Howse and Yellowhead passes, through the Rocky Mountains, have already been fully reported on. Northward of the latter I have information of three other passes, which I give in their order of succession, northwards.

First.—The Smoky River Pass: From the north branch of the Fraser, on the west side of the mountains, to the head waters of the Smoky River, on the east side.

Second.—The Pine River Pass: From the Parsnip, or south branch of the Peace River, on the west side of the mountains, ascending by a small river to the Summit Lake, thence descending the eastern slope of the mountains by the Pine River.

Third.—The Peace River Pass: Following the course of the Peace River which rises on the west side of the mountains and flows directly through these to the plains northeast of them.

It would be next to impracticable to connect either of these passes with any one through the Cascade Chain south of Bute Inlet. But in connection with the latter the Smoky River Pass appears to be in the most direct line to the points necessary to be reached east of the Rocky Mountains. I, therefore, directed my enquiries more particularly to that pass; but almost the only information I could obtain about it is from the following memorandum kindly furnished me by A. C. Anderson, Esq.:—

"As regards the pass at the head of the North Fork, towards which Mr. Smith's enquiries were specially directed, I can say nothing of my personal knowledge. All the information I possess is from other sources and chiefly from my Bows-man in 1835, an old Iroquois guide, named Réré, who had a great knowledge of the country. He pointed out to me a stream on the left as we ascended, which he called Riviere a la Boucane (so named in my map) for the reason, as he explained, that there was here a short Portage, commonly used by the Indians, and formerly by the Iroquois trappers of the Northwest Company, falling on the North Branch (of the Fraser) by which there was a communication through a pass in the Rocky Mountains, with the Riviere a la Boucane or Smoky River, falling into the Peace River."

"Of the nature of the Pass referred to, in the Rocky Mountains, I cannot give an opinion; but that it is tolerably practicable, at least, I infer, both from what Réné told me, and from the fact that he had received from Indians some buffalo meat, in a fresh condition, which had been killed on the Smoky River opposite to the heads of the north branch of the Fraser."

"If the exploration of the Pass in question should be decided upon, and the route eventually found advantageous, I would suggest that a convenient line of approach from the Athabasca would probably be found by the valley of the Riviére de Baptiste."

"The trappers formerly frequenting Jasper House, usually followed Free-man's River or some of the other streams issuing from the same direction near Jasper's, when on their way to Smoky River, their frequent resort, but of course the river first mentioned, issuing lower down, would have the advantage of shortness, and would possibly present other facilities as being the largest and therefore occupying the widest valley."

Mr. Anderson has also told me that Réné was never tired of expatiating on the merits of this pass. I have, however, no expectation that it will be found so low as the Yellow Head; for Indians have little appreciation of heights, and provided they get a trail tolerably free from broken ground, swamps and fallen timber, they would think it very good though it might have insuperable difficulties for railway construction.

Of the Pine River Pass I could learn very little, but it is said that canoes can be taken up the stream on the west side of the mountains, from the Parsnip River to the Summit Lake with very few portages, and that the Pine River flows out of the lake northeasterly to the Peace River. If this is the case the Pass cannot be very high.

As you have sent an exploring party specially to examine the Peace River, I need say little about it here; but from what I have heard of it, and from the fact of the river running directly through the Rocky Mountain chain, and consequent lowness of the Pass, the same kind of difficulties, though perhaps modified, would be found as in the Fraser River in its passages through the Cascade chain.

All these northern passes are objectionable for the railway route, not only on account of the greater length of the line, but more especially that a greater proportion of it would be within the region of deep snow that extends along the southwestern slopes of the Rocky Mountains, and a considerable distance on the central plateau adjoining.

It is very doubtful if any pass will be found so favorable in this respect as the Yellowhead.

Yours most truly,
MARCUS SMITH.

APPENDIX L.

Extracts from Report by Lieutenant H. SPENCER PALMER, *Royal Engineers, on the North Bentinck Arm and the Route thence through the Cascade Chain of Mountains to the interior of British Columbia.*

The voyage from Victoria to North Bentinck Arm, in length about 440 miles, affords those who perform it an opportunity of witnessing some of the most intricate, and perhaps the most wonderful inland navigation in the world. The steamer course winds through an archipelago of surpassing beauty—islands of almost every size and shape, presenting an ever-recurring succession of mountain and valley, headland and bay, and embracing all the beauties of alternate prairie and woodland scenery.

North of Jervis Inlet the mountains which cluster round it and the other inlets to the south of it, and which, from their detached position, have been spoken of as a distinct coast range, become blended by continuous chains with the superior crest of the Cascade Mountains which, from this point northward, may be said to run in a general northwesterly direction, parallel, or nearly so, to the coast, and distant from it about 50 miles. This chain, which appears to increase in altitude with the increase of latitude, is here and there partially pierced by the numerous deep-water arms of the sea which form the principal characteristic feature of the whole western coast-line of British North America, and, extending inland to distances of from 20 to 100 miles, have received severally the names of Arms, Inlets, Sounds and Canals.

By the few who, for trading and other purposes, have penetrated these arms of the sea strange stories are told of the grand and gloomy character of the neighbouring scenery. Glaciers, rarely met with elsewhere in the country, are here of frequent occurrence, and, near Knight's Canal, we hear of a river which flows for 15 miles through a magnificent glacier tunnel 100 feet in height and from 100 to 150 yards in breadth.

In the Seymour Narrows, through which the steamer track passes, occurs the tidal junction of the waters which separate Vancouver Island from the mainland. Here the flood tides from the Pacific, flowing respectively to the southeast through Queen Charlotte Sound and to the northwest through the Gulf of Georgia, meet and form violent, cross, jumping seas, which, especially when aggravated by high winds, cause danger of no small moment to light craft. Tides are said to be of excessive strength throughout nearly the whole of this inland navigation, the winds usually extremely variable and anchorages unfrequent, and hence it is reasonable to infer that the passage to the north by the Gulf of Georgia, although peculiarly favorable to steam navigation, should never be attempted by any large vessels without the assistance of steam power.

Passing the north end of Vancouver Island, the course crosses Queen Charlotte Sound and runs to the east of Calvert Island. The Sound thus crossed, about 30 miles broad, is open to the North Pacific, and subject therefore to heavy ocean swells, whose magnitude and consequent danger are heightened by the meeting of the ebb tides which, running along the mainland in northwesterly and southwesterly directions, rush to the ocean through this Sound. Violent gales are at all seasons of frequent occurrence here, and, until reaching Smith's Inlet, no harbour or anchorage interrupts the bold, bluff front of the mainland.

North Bentinck Arm, a mere water-filled indentation in the mountains, some 25 miles in length and from 1½ to 2½ miles in breadth, may be taken as a fair type of the other inlets on the coast. Piles of mountains broken up towards the seaboard in singularly tumbled though rounded masses, but increasing in altitude and compactness as they approach the centre of the Cascade range, snowy peaks, pine-clad slopes, rugged cliffs and precipices, naked, shapeless masses of trappean and granite rocks projecting upwards to vast heights, gloomy valleys and picturesque waterfalls; these in constant succession, form an aggregate of sublime and wild, though strangely desolate and unattractive scenery.

Like North Bentinck Arm, we are told, in these general characteristics, though perhaps even more wild and bleak as the latitude increases, are the other inlets on the northwest coast. In all the mariner meets with water of vast depth and rarely encounters obstacles to navigation in the shape of rocks or shoals, though all are alike subject to violent winds and powerful tides, and therefore unfavorable to navigation by sailing vessels of large size.

North Bentinck Arm receives at its head the waters of the Bella Coola or Nookhalk River, a rapid mountain stream probably 80 miles in length, which, rising beyond the principal crest of the Cascade Mountains, flows through and drains a portion of that range and, subsequently, the chasm or valley formed by the continuation of the mountain walls of North Bentinck Arm. Another stream of smaller dimensions, called by the natives Taantsnee, flows through a gap in the range to the north of the arm, and discharges itself into its northeastern corner. On the 2nd of July, 1862, at 1 p.m., the thermometer in the shade standing at 56° Fahrenheit, the temperature of the Nookhalk River was ascertained to be 49°7 Fahrenheit, and the same result was obtained with regard to the water of the head of the arm, which, owing to the volume of the Nookhalk, is fresh for some distance outwards.

The valley of the Nookhalk for 40 miles from its mouth is undoubtedly of estuary formation, low and, in many places, swampy throughout, and to the same process by which, for ages past, the land has been gradually forcing back the waters of the ocean, viz.: the deposit of the vast quantities of alluvium and drift which have been brought down by the Nookhalk, is to be attributed the existence of the large, flat mud-shoal which extends across the head of the arm. This shoal, composed of black, fetid mud, supports a rank vegetation of long swamp grass for about half its distance outwards ; it is bare at low water spring tides for about 700 yards from high water mark, and covered at high tide with from 1 to 8 feet of water, and at a distance of 800 yards from shore terminates abruptly in a steep, shelving bank on which soundings rapidly increase to 40 and soon to 70 fathoms. On this shelving bank, where it approaches the south shore of the arm, exists the only available and partially sheltered anchorage in the neighbourhood, and, as instancing the extreme narrowness of the belt of water in which it is practicable to anchor, I may mention that, when here, I was assured by Captain Swanson of the steamer Labouchere, then lying in 16 fathoms water, that nothing but the outward flow from the Nookhalk river prevented his vessel from swinging to the westerly winds which were blowing at the time, in which case, had she remained at anchor, she must inevitably have tailed on the shoal.

Another small anchorage is said to exist at the mouth of the Nomaamis river, about 3 miles down the north shore of the arm, but, as this point is too far removed to be of any importance with reference to the future establishment of a route, I did not lose time in examining it.

From the present anchorage upwards, steep rocky cliffs run at a high angle into the water of the arm, and, further west, into the low, swampy land, intersected by small *sleughs* from the Nookhalk river and from the sea, which extends for some distance within actual high water mark. To build wharves and perhaps a few sheds on the rocky shores of the anchorage, and thence a road along the mountain sides to the spot indicated in the accompanying plan as suitable for a town site is the only method I can arrive at by which to meet the requirements of any future traffic that may occur on this route. The site I have selected is, in fact, the only available ground in the neighbourhood, a sloping tract of land of about 1200 acres in extent, covered with a profuse wild vegetation of clover, vetches or pea-vine, grass, and berry-bushes of various descriptions, timbered in places and generally dry, but breaking up towards the river and the head of the arm in low swamps and ponds, and damp, grassy hillocks and ridges.

On the north side of the river much of the land is heavily timbered within the line of high water mark with cedar, cottonwood and some species of fir, but is so singularly dotted with low marshes and damp, steaming ground which encourages a dense growth of the *penax horrida* as to be unadapted to white settlement, though the natives, who dwell in confined areas and derive many of their necessaries from the products of swamp lands, would probably value it highly, and, retaining this, be content to abandon to the whites the drier land on the south side of the river.

Half a mile from the mouth and on opposite sides of the Nookhalk are situated two Indian villages, forming a settlement named Ko-om-ko-otz, and presided over by the chief Pootlas. Two miles further up on the south bank is another large village named Soonochlim, ruled by Annokeetsum, and the whole population numbered, when I was there, about 1200 souls. The villages are similar in their general character to those met with in the southern part of British Columbia, but remain in their purely savage originality, unmodified by the touch of civilization. They consist of rude clusters of dwellings, built of posts and huge rough slabs of cedar, and some of the lodges, more especially those of the chiefs and medicine-men, are gaudily painted with strange devices, prominent among which is the red hand, the Indian symbol of power. The natives themselves are physically a fine race, tall, robust and active. They, as is usual with the Indian tribes west of the Cascade mountains, subsist chiefly upon salmon and berries, eaten fresh in summer and dry in winter, and also on the flesh of the wild animals hunted for the sake of their furs during the winter months; but they possess the usual native characteristic of improvidence, and, in the spring, are frequently reduced by want of food almost to skeletons. The salmon are caught in large quantities during the months of July and August, partly in nets, but by far the greater number in ingenious but rudely constructed weirs, which are built across the river and admit of the escape of few only of the fish.

The arm is navigated by large canoes of the southern pattern, but those used on the Nookhalk are of a different description, and admirably adapted for the dangerous and difficult character of the navigation. The largest kinds of these are about 25 feet in length and 2½ feet in breadth, built of cotton-wood, that wood being more easily worked than the cedar, with flat floors, and sides nearly straight from stem to stern, a form which facilitates the work of polling. On raised platforms in the bow and stern stand the two natives on whom principally depends the guidance of the canoe, and the unerring skill and nerve with which heavily laden canoes are propelled, through dangers of no trifling description, is worthy of admiration.

Hudson's Bay blankets and shirts are the usual articles of native attire, and they adorn themselves with nose-rings, ear-rings and fantastic head-dresses of wampum. They have not yet come within the influence of Protestant or Roman Catholic Missions and adhere pertinaciously to the old Indian superstitions and customs, maintaining, as regards their religious and other ceremonies, a jealous secrecy which defies the scrutiny of the white man. The language is the most guttural and difficult on the Coast.

In moral character the Bella Coolas are degraded specimens of the red Indian. Prostitution, polygamy, and other worse vices at which civilized men shudder, are of frequent occurrence amongst them. Thieving is an art that all attain to perfection, and, in intercourse with them, I had unpleasant opportunities of becoming acquainted with the incredulity, falsehood, and avarice which form prominent traits of their character. Sir Alexander Mackenzie christened Ko-om-ko-otz "Rascals' Village," and I willingly contribute my testimony to the justice of the title.

To their immoral habits of life, and partly also to wars with the Hydahs, the bloodhounds of the northwest coast, may be attributed the gradually progressing extinction of the race, clear evidence of which is afforded by the sight, at different points further up the river, of the ruins of deserted lodges, once the habitations of large families of Indians, that have gradually dwindled away by death until the few survivors have incorporated themselves with the larger bands.

Smallpox has this year contributed a sad quota of death. During my tay there this disease, which had only just broken out when I arrived, pread so rapidly that, in a week, nearly all the healthy had scattered from he lodges and gone to encamp by families in the woods, only, it is to be feared, to carry away the seeds of infection and death in the blankets and other articles they took with them. Numbers were dying each day; sick men and women were taken out into the woods and left with a blanket and two or three salmon to die by themselves and rot unburied; sick children were tied to trees, and naked, grey-haired medicine-men, hediously painted, howled and gesticulated night and day in front of the lodges, in mad efforts to stay the progress of the disease.

On the 9th of July we commenced our journey up the valley, the party consisting of Lieutenant Colonel Foster, M. P. P., Sappers Edwards and Breakenridge of the Royal Engineers, a packer and myself, with eight horses. It would be tedious to describe at length the various obstacles that opposed our progress, and the sundry shifts to which we were put in prosecuting our difficult journey. In this report I propose simply to divide the country travelled over, into sections in which the leading natura features are sufficiently uniform to admit of one general description fo each, and commence, accordingly, by speaking of the FIRST SECTION some 43 miles in length, extending from North Bentinck Arm to Shtooiht the head of canoe navigation on the Nookhalk.

The Nookhalk River, with its rapids and rocks, its numberless islands bars and *snags*, whitish clay-charged water and densely wooded banks bears a striking resemblance to the Lillooet river, well known to yoursel and to most travellers in British Columbia. Owing to the generally level character of the valley, the main stream and its *sleughs* water a larger area than the Lillooet, though its volume is probably not more than two-thirds as great. The banks, which for some distance back are usually low and flat, and liable in many places to inundation, support a thick growth o cotton-wood (a species of poplar), willow and other trees peculiar to damp soils, and an underbrush of the densest nature, consisting of cranberry dogwood, crab-apple and many other similar bushes. The river, as is usual with streams flowing through alluvial soils, is excessively tortuous alternating with great regularity from side to side of the valley, but very rarely approaching the mountains so closely as to render the task of roadmaking a difficult one. It is almost superfluous to add that the stream is impassible for steamers, but canoe navigation as far as Shtooiht is, I believe, practicable at most seasons.

Countless tributaries, of every size from tiny cascades to impetuous mountain torrents, feed the Nookhalk on its passage through the hills. Prominent among the latter are the Skomahl, the Snootchlee, the Noosatsum and the Tcheetsmeeltanie from the south, the Tsalloomt, the Tsatleanootz and the Kahylkst from the north, all streams of some size which drain large longitudinal valleys of the mountain system.

The Nookhalk Valley, which averages from one-half to one and a-half miles in width, opening out considerably at the confluences of the principal tributaries, is walled in by giant mountains of from two thousand to six thousand feet in height, presenting the usual variety of scenery met with in mountain travels in this country. Some of the slopes, particularly those between Soonochlim and Nooketz, are perfectly devoid of soil, timber or covering of any kind, and rise very abruptly from the valley, massive unbroken walls of granite and trap, standing in stupendous contrast to the forest scenery on the river banks and islands.

The line of the most elevated crest of the Cascade range crosses the Nookhalk near Nooskultst, 22 miles from its mouth, maintaining apparently a direction parallel to the general coast-line. But although a principal crest, this is by no means a principal watershed, for, in these latitudes, the rains and snows which fall on either slope of the range are quickly conducted to the Nookhalk and the other similar arterial streams near the coast, and restored by the most direct path to the sea. Two peaks of this range, Mounts Pope and Deluge, standing on opposite sides of the river and respectively about 5,000 and 6,000 feet in height, attract attention by their massiveness and their superior altitude. The latter, crowned by a cluster of jagged, picturesque peaks, is the subject of tradition among the Bella Coola Indians, for they believe its summit to have been the abode of an ancient chief of their tribe and his squaw, who climbed there at the time of the Deluge and were saved to perpetuate their race.

Other magnificent mountains and clusters of mountains are met with on the journey, embracing most of the elements of grandeur that can be imagined in scenery of this description, and the numberless waterfalls which are seen in many parts, though more particularly towards the upper end of the valley, and which, on the melting of the snow, precipitate themselves in considerable volume down the crannies and crevices of the mountain sides, are worthy of notice, as adding much to the sublimity of the scenery.

The valley abounds with the natural features usually met with at low altitudes in this country; tracts of heavy forest and dense underbrush, such as we see in the valley of the Lower Fraser, succeeded here and there by groves of alder, willow and swamp woods; occasional open patches of low berrybushes, forests of smaller timber with a comparative absence of brushwood, large alluvial flats, abrupt mountain sides, poor gravelly soil, patches of swamp land, innumerable brooks and *sleughs*, and large quantities of fallen and, occasionally, burnt timber; these are the prominent characteristics of the Nookhalk valley, and will at once be recognized as incidental to the valleys of most of the mountain streams on the coast.

An Indian trail of the rudest description winds up the valley, usually following the river in all its sinuosities, and also offering great impediments to travel. It is found to be impracticable to pack the horses over this section on account of the extreme narrowness and frequently miry nature of the trail, the fallen timber, the absence of bridges, &c; and the baggage was transported as far as Shtooiht in a canoe. At three deserted Indian village-sites we found sufficient grass growing to afford temporary subsistence for the animals. These deserted sites are named Nookeetz, Asananny and Nooskultst, distant respectively ten, sixteen and twenty-two miles from Ko-om-ko-otz, and, at the latter, the trail crosses from the left to the right bank of the river at a spot apparently as well suited for that purpose as any that could be found. Another large village, at present inhabited, exists at Nootkleia, thirty-four miles from Ko-om-ko-otz, at the confluence of the Kahyklst and the Nookhalk, and here also we found fair feed for a day or two for our small band of horses.

Although the present trail passes through a great deal of swampy land, there is nothing to prevent a good bridle-path or waggon-road being carried the whole way to Shtooiht, care being taken to hug the mountain sides where it is necessary to avoid low, soft ground, a measure which would also shorten the distance materially. If a road of any kind be made, I think it cannot do better than follow the left bank to the Indian crossing at Nooskultst, thus avoiding two bluffs on the right bank at Soonochlim and Asananny respectively, then cross and continue as far as Shtooiht on the right bank.

Happily in this valley there is a comparative absence of rocky bluffs running sheer into the river, which necessitate the task of blasting, for the stream rarely approaches the actual bases of the montains, and "canons" or "passes" nowhere occur.

There is an unavoidable slide of fragmentary rock, half a mile in length, at 27 miles from Ko-om-ko-otz, and rock *in situ* would be met with at a point about 2 miles above Nootkleia, but neither difficulty is likely to prove of a serious nature.

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At Shtooiht, a small Indian village situated in the heart of piles of majestic but strikingly bleak and forbidding mountains, the trail leaves the Nookhalk and travels up the Atnarko, a large, clear-water tributary, here nearly equal in size to the Nookhalk. The latter river, which from this point upwards receives the Indian name Talchako, runs in a south-southeasterly direction, its course being traceable for about ten miles, and the Atnarko takes a general east-northeasterly direction as far as Cokelin or the Great Slide, fourteen miles distant, at which point will terminate the SECOND SECTION of the journey.

Although the Atnarko valley is similar in many general characteristics to that of the Nookhalk, as its stream is ascended so do the difficulties of progress increase. The valley, which near its mouth is about one mile in width, gradually contracts, and the mountains, although diminishing sensibly in apparent altitude, become more and more rugged, and frequently jut out in low, broken masses into the stream. The Atnarko receives two tributaries of some size from the north, viz.: the Snookhalk at six miles, and the Cheddeakulk at ten miles from its mouth; it gradually contracts in volume, soon losing the proportions of a river and dwindling, beyond the Cheddeakulk, to a mere brawling torrent with a very rapid fall and hemmed in by steep and continuous cliffs.

Here the first serious obstacles to road making are met with. From the crossing of the Cheddeakulk to the foot of the Great Slide mountains crowd closely in upon both sides of the stream; frequent extensive slides of fragmentary trap rocks of all sizes run either directly into the river, or into the low, swampy lands bordering it, which are liable to inundation at the freshets, and the Indian trail which winds along their faces is difficult and almost dangerous for travel. These slides vary from 300 to 600 feet in height, and are capped by rugged cliffs extending to an average altitude of 1500 feet above the river, and, since they are unavoidable, the labour of trail-making between Shtooiht and the Great Slide will be considerable, and entail a probable expense of £1000.

Thus far the journey of 57 miles from North Bentinck Arm, owing to bad weather, trouble with the natives (which on one occasion nearly cost us our lives) and the difficulties of advancing, had occupied eighteen days.

From Shtooiht to Taparntowoot, a distance of eight miles, the baggage had been packed on the horses, the difficulties having been such as our small party were able to overcome in six hours, but an inspection of the trail beyond the latter point convinced me that it was desirable to push on without the animals, and to prosecute the remainder of the journey to the Fraser on foot. This was done; Indians, who did me the honour to accept gold instead of blankets in payment, were with much difficulty procured to pack the baggage, the horses were left in charge of the packer, and at noon on the 27th of July we commenced the THIRD SECTION of the journey, 16 miles in length, extending from Cokelin to the summit of the Precipice.

At Cokelin, 1,110 feet above the level of the sea, famous among the natives for its raspberries, which grow in great profusion, the trail leaves the Atnarko running about southeast and strikes to the northward, directly up the face of the Great Slide, at a high angle of elevation. The slide, similar in character to those frequently met with in the mountains, though perhaps the stones composing it are smaller than is usual, is simply a mountain side of disintegrated trap rock about one mile in length, forming the northern slope of the valley of the Atnarko, and only separated from the slides lately passed by the glen of a mountain torrent. The height of the actual loose rock, as indicated by barometric measurement, is about 1120 feet, the trail barely even winding up this portion, but wriggling almost directly up the face in would-be zigzags bitterly trying to pedestrians. Above this it is lost among cliffs and hollows dotted with small timber, and rises more gradually until, 5 miles from Cokelin, an altitude of 1780 feet (2890 feet above the sea) is attained.

Corresponding to this increased elevation is the change in the character of the vegetation and the scenery. The trail now emerges on an elevated, rolling district, where the mountains, with whose summits we are nearly on a level, seem of inconsiderable height and lose much of their rugged appearance. Small, stunted firs take the place of the large pines and cedars of the valleys, the trail, though here and there rocky, improves, the soil becomes sandy and light but firm, brush less plentiful, and grass, though of poor quality, appears in patches. Down by a gradual descent of 500 feet to the brook Hotharko, a tributary of the Atnarko, and up its valley 7 miles in an east-north-easterly direction to its forks, meeting with no serious obstructions but fallen timber and occasional small rocky slides. The space between the forks of the Hotharko, which run in south-easterly and west-northwesterly directions, is occupied by a peculiar mountain mass of basaltic rock, 1350 feet in height, which has received the name "The Precipice." The ascent of this mountain is excessively steep, the trail at first running up the backbone of a singular spur, further up winding among crumbling fragments of rock, and, finally, reaching by a dizzy path the summit of the perpendicular wall of rock, 100 feet high, which crowns the mass, and from which it derives its name.

The cliff is composed of blocks of columnar basalt in the shape of multangular prisms averaging, in their perfect state, about two cubic feet in size, usually stained of a dull red colour and somewhat vescicular. The blocks are fitted together as perfectly as if by human agency, and the layers are horizontal; thus, on the summit, which is perfectly level, patches are met with in which, the scant soil having been washed away, the jointing of these singular stones, almost resembling Mosaic pavement, is clearly visible ; and, towards the edges of the cliff, large portions of the rock have crumbled away, leaving standing in many places abrupt, columnar masses of as much as fifty feet in height, which, viewed from a short distance, almost assume the appearance of massive artificial and battlemented structures. * * * * * * * * *

The FOURTH descriptive section embraces sixty miles of the route, viz: from the Precipice to the Summit Lake. Arriving at the top of the Precipice, 3840 feet above the level of the sea, the traveller enters on the level of the great elevated plateau which intervenes between the Cascade Mountains and the Fraser. Looking eastward the plateau presents but few objects to attract attention, and the eye grows weary in wandering over a vast expanse of waving forest, unbroken save by the lakes and marshes which are invisible from the general level. To the west the towering peaks of the Cascade range come clearly into view ; its limits, which we have now reached, being indicated by isolated clusters of hills to the south of us, here and there soaring up into great, massive, lonely peaks, but preserving no distinct arrangement.

Again with the increased altitude is noticed a characteristic change in the vegetation, and the verdure of the plateau seems to grow thinner and inferior as we travel eastward. Shallow, meagre soil, consisting chiefly of decomposed granitic and trappean rocks, supports a dense forest growth of stunted firs, rarely exceeding fifteen inches in diameter, and an inferior grass, which becomes poorer and poorer after passing Sutleth Lake ; kinni-kinnik or *uva ursi*, the native tobacco, is almost universal ; here and there wild strawberry plants and, occasionally, a scant underbrush of wild roses appear, and a thin growth of cotton-wood fringes the banks of the running streams.

The altitude of the trail to the east varies slightly with the undulations of the country, and the summit ridge, near which water flows respectively to the sea and to the Fraser, is crossed at a distance of about fifty-five miles from the Precipice, and a height of 4360 feet above the sea. The extreme elevations of the rolling plateau are very inconsiderable, seldom more than 800 feet above the general level. * * *

Our journey lay along a narrow Indian trail of varied character, sometimes passing over smooth, level tracts, excellent for travel, sometimes traversing rocky districts and boulder beds, winding a great deal to avoid as far as possible the swamps, and crossing them, when obliged to do so, almost invariably at the narrowest part. In the woods a great deal of fallen timber was met with, and our path frequently lay for miles through dreary tracts of naked trunks, scorched and blackened by the passage of the forest fires, which are frequently started by lightning or the negligence of the natives, and sweep over immense areas. * * * *

The belt of country lying between the Summit Lake and the Chilcotin river, and forming the FIFTH SECTION of our journey, presents more attractive features than any other portion of the route. Ranges of rolling hills of as much as 1000 feet in height enclose broad, open valleys, watered by gentle streams, and embellished with chains of picturesque lakes

Although considerable tracts of dense forests are met with on the heights and on the mountain slopes, this gives way in the lowlands to an open-timbered, grassy country, such as is met with in the Similkameen and other well-known districts of British Columbia, and the valleys also embrace numerous comparatively level, open prairies of various extent, which afford bunch-grass pasturage in fair abundance and will probably be found to be convenient wintering posts for some of the animals of the upper country. But the soil cannot be said to possess properties favorable to agriculture; it is cracked and sandy and excessively dry, and the bunch-grass, nowhere growing thickly, is mixed with large quantities of *artemisia* peculiar to poor, unproductive lands.

At Puntzee, signifying in Carrier language "Small Lake," thirty-nine miles from the Summit Lake, my Indians left me, and I was detained six days in efforts to procure other means of transport for the remainder of the journey. From an elevated point in its neighbourhood a fine view was obtained of the surrounding country. Looking back to the west the cloudy outlines of the Cascade range, distant from 60 to 100 miles, and bounding half the circle of the horizon, presented an almost unbroken front, a solitary gap in the southeast disclosing the probable entrance to the valley of the Homaltho river flowing to Bute Inlet. In the northeast and east the view was limited by the high mountainous districts of the Quesnel and Swift rivers, and the terraced ranges bordering the valley of the Fraser, the intervening districts on all sides being occupied by a great, waving forest plateau, embracing high, dry ridges, swamps, lakes, valleys and prairies, such as have formed the subjects of foregoing descriptions.

As regards routes from the coast, the impression conveyed by this glimpse at a very large tract of country is that, on emerging from the Cascade range, the principal difficulties of travel are passed, and that, thence, there is no impracticability in making a road across the plateau to strike the Fraser valley at almost any point south of the fifty-third parallel. The determination of the best line through so extensive a district would necessarily be a labour involving weeks or even months of exploration, the main object of course being to avoid as far as possible the lakes and swamps, and, guided by the relative geographical positions of the termini, to lay out as straight a road as the natural features of the country admit of.

At Puntzee the Indian trail from Bute Inlet, said by the natives to be distant five good days' travel, (probably 125 miles) joins that from North Bentinck Arm.

* * * * * * *

Leaving the Chilcotin and mounting a steep, grassy hill, about 300 feet high, which forms the eastern slope of the valley, we again attained the general level of the plateau and entered on the SIXTH and last section of the journey, extending to Fort Alexander, a distance of about eighty-seven miles.

To describe this in detail would be merely to recapitulate what has been said of the fourth section.

* * * * *

It was a relief to emerge from this bleak succession of forest and swamp and, twenty miles from Alexander, to welcome once more the sight of a brawling stream, the *Sananorringlee, skirted by forests of large timber and terraced hills of bunch grass. Twelve miles down its valley noticing at each stage of our progress indications of a gradually decreasing altitude, after which a walk of eight miles over the basaltic range bordering the valley of the Fraser led us to Fort Alexander.

We reached the Fort on the evening of the 13th of August with one meal left. The trip from the Slide had thus occupied 17½ days, but six of these were spent at Puntzee waiting for horses, leaving 11½ days as the actual travelling time.

A reference to the figures of the report itself, or of the table at the end, shews the estimated distance from the Slide to Alexander to be 21 miles, but it must be remembered that the estimate applies simply to the present Indian trail and has no reference whatever to air-lines or possible improvements. Undoubtedly modifications, not only of minor details but frequently of large portions of the present line, would be desirable and necessary in the event of a trail or road being established, and it is reasonable to infer that an improved route from Cokelin to Alexander would not exceed 180 miles in length.

* * * * *

August is the hottest, January the coldest month of the year at Alexander. In the former the thermometer in the shade averages 70 ° Fahrenheit, and countless grasshoppers and other insects swarm in the valley. In the latter the river is closed with ice, and quicksilver freezes frequently. Snow falls to a depth of about eighteen inches, usually appearing at the end of November and lying on the ground four months, but the duration of winter is extremely variable. There is no regular wet season, though June is usually the rainiest, August, September and October the driest months of the year, and, as the night frosts prevail far into the summer, the crops are invariably late.

* * * * *

Recurring once more to the route across the plateau, I must notice, a one of its most prominent features, the almost entire absence of hill between the Precipice and Alexander, the valleys of the Pootzeako an the Chilcotin, and the final descent to the Fraser being the only point where hills worth mention occur. As will be gleaned from previou descriptions, swamps are very general, so much so that, after leaving th summit of the Precipice, we never encamped with dry feet. Probably, i all, the actual extent of swamps traversed, in pieces of from 20 to 40 yards in length, does not exceed ten miles, but, to ensure this immunity frequent long detours were made in gaining the narrowest crossing point of the marshes.

* * * * * *

Of the climate of the plateau I can not give any reliable data, thoug it is probable that, owing to its great altitude, which from the Slide eastwards nearly everywhere exceeds 2000 feet, and reaches to more tha 4000 feet above the level of the sea, the snow lies on the greater part of i for at least seven months of the year, viz: from November to May inclusive; and it is not likely that it will in this respect compare favourabl with the elevated districts traversed by the routes lying east of the Fraser, where the open nature of large tracts of the country favours the earl disappearance of snow to an extent not likely to obtain in the dens forests of the Atnayo and Chilcotin plateaux.

* * * *

It is the province of the navigator to discuss at length the merits o North Bentinck Arm as a harbour, and to weigh the relative advantages a for foreign commerce afforded by it and by Victoria or New West-r respectively; and the latter question has, in all probability, ed ere this the attention of officers of Her Majesty's Navy. Apart these considerations, as well as from the questions of climate and aking, my own impression is that, viewed simply with reference to ravel, the Bentinck Arm route is, from its high continuous elevation, om the general absence of good soil and pasturage in the districts it traverses, unlikely, for the present at least, to acquire importance rterial highway to the established gold mines of this country.

ute Inlet appears to possess far greater advantages of geographical n, and we learn from the Admiralty survey that there is a passable rage at its head.

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in branch of the River Narcoslee, which empties itself into the Frazer about twenty miles above Fort Alexander.

TABLE

Shewing the approximate altitudes above the Sea of some points on the nor Bentinck Arm Route.

STATION.	APPROXIMAT HEIGHT IN F ABOVE THE S LEVEL.
Nookeetz (ruined village,)	107
Asannany* do.,	227
Nooskultst do.,	316
Nootkleia (inhabited village,)	392
Shtooiht (Springs,)	464
Atnarko river at Taparntowoot,	928
do. at Cokelin (Foot of Great Slide,)	1119
Summit of the Great Slide	2280
Summit of the mountain above the slide	2890
Hotharko brook at the foot of the Precipice	2490
Summit of the Precipice	3840
Nimpoh	3601
Lake Towteestsan	3580
Summit altitude of the trail on the plateau	4360
Summit Lake,	40'0
Lake Chantslar	3820
Lake Chant-hopeen	3780
Fort Alexander	14'0

NOTE.—An accident to the barometer prevented any observations for altitude being taken betwe Lake Chant-hopeen and Fort Alexander.

H. S. P.

APPENDIX M.

Extracts from the Journal of a voyage through the Northwest Continent of America by SIR ALEXANDER MACKENZIE; *Descriptive of the Country on the route taken by that traveller from the Central Plateau of British Columbia through the Cascade Mountains to the Pacific Coast.*

July 11*th*, 1793.—I passed a most uncomfortable night, the first part of it I was tormented with flies, and in the latter deluged with rain. In the morning the weather cleared, and as soon as our clothes were dried we proceeded through a morass. This part of the country had been laid waste by fire, and the fallen trees added to tha pain and perplexity of our way. An high, rocky ridge, stretched along our left. Though the rain returned, we continued our progress till noon, when our guides took to some trees for shelter. We then spread our oilcloth, and with some difficulty made a fire. About two the rain ceased, when we continued our journey through the same kind of country, which we had hitherto passed. At half-past three we came in sight of a lake; the land, at the same time, gradually rising to a range of mountains whose tops were covered with snow. We soon after observed two fresh tracks, which seemed to surprise our guides, but they supposed them to have been made by the inhabitants of the country who were come into this part of it to fish. At five in the afternoon we were so wet and cold (for it had at intervals continued to rain) that we were compelled to stop for the night. We passed seven rivulets and a creek in this day's journey. As I had hitherto regulated our course by the sun, I could not form an accurate judgment of this route, as we had not been favoured with a sight of it during the day; but I imagine it to have been nearly in the same direction as that of yesterday. Our distance could not have been less than fifteen miles. * * *

12*th July*. * * At seven o'clock, however, we were so fatigued, that we encamped without them; the mountains covered with snow now appeared to be directly before us. As we were collecting wood for our fire, we discovered a cross road, where it appeared that people had passed within seven or eight days. In short, our situation was such as to afford a just cause of alarm, and that of the people with me was of a nature to defy immediate alleviation. * * * *

The weather had been cloudy until three in the afternoon, when the un appeared, but surrounded, as we were, with snow clad mountains, he air became so cold, that the violence of our exercise was not sufficient o produce a comfortable degree of warmth. Our course to-day was from west to south, and at least thirty-six miles. The land in general was very baren and stony, and lay in ridges, with cypress trees scattered over them.

We passed several swamps, where we saw nothing to console us, but a few tracks of deer.

July 13*th*.—The weather this morning was clear but cold, and our scanty covering was not sufficient to protect us from the severity of the night. About five, after we had warmed ourselves at a large fire, we proceeded on our dubious journey. In about an hour we came to the edge o a wood, where we perceived an house, situated on a green spot, and by th side of a small river. The smoke that issued from it informed us that i was inhabited. I immediately pushed forward towards this mansion, whil my people were in such a state of alarm, that they followed me with th utmost reluctance. On looking back I perceived that we were in an India file of fifty yards in length. * * *

She added also, that from the mountains before us, which were covere with snow, the sea was visible; and accompanied her information with present of a couple of dried fish. We now expressed our desire that th man might be induced to return, and conduct us in the road to the sea. *

14*th* *July*.—Our guide informed me that there is a short cut across th mountains, but as there was no trace of a road, and it would shorten o journey but one day, he should prefer the beaten way. We according proceeded along a lake, west five miles. We then crossed a small riv and passed through a swamp, about southwest, when we began gradual to ascend for some time, till we gained the summit of an hill, where w had an extensive view to the southeast, from which direction a conside able river appeared to flow, at the distance of about three miles: it was r presented to me as being navigable for canoes. The descent of the hi was more steep than its ascent, and was succeeded by another, whose to though not so elevated as the last, afforded a view of the range of mou tains, covered with snow, which, according to the intelligence of our guid terminates in the ocean. We now left a small lake on our left, then crosse a creek running out of it, and at one in the afternoon came to an house, the same construction and dimensions as have already been mentioned, b the materials were much better prepared and finished. The timber w squared on two sides, and the bark taken off the two others; the ridge po was also shaped in the same manner, extending about eight or ten fe beyond the gable end, and supporting a shed over the door; the end of was carved into the similitude of a snake's head. Several hieroglyphics an figures of a similar workmanship, and painted with red earth, decorated th interior of the building. * * *

We continued our journey along the lake before the house, and cros ing a river that flowed out of it, came to a kind of bank or weir formed b the natives, for the purpose of placing their fishing machines, many which, of different sizes, were lying on the side of the river. Our guid placed one of them, with the certain expectation that, on his return, h should find plenty of fish in it. We proceeded nine miles further on good road west south-west, when we came to a small lake: we then cros ed a river that ran out of it, and our guides were in continual expectatio of meeting with some of the natives. To this place our course was a mil and a half in the same direction as the last. At nine at night we crosse a river on rafts, our last distance being about four miles southeast on winding road through a swampy country, and along a succession of small lakes. We were now quite exhausted, and it was absolutely necessary for us to stop for the night. The weather being clear throughout the day, we had no reason to complain of the cold. Our guides encouraged us with the hope that, in two days of similar exertion, we should arrive among the people of the other nation.

* * *

16th July.—Our course was about west south-west, by the side of a lake, and in about two miles we came to the end of it. Here was a general halt, when my men overtook us. I was now informed that some people of another tribe was sent for, who wished very much to see us, two of whom would accompany us over the mountains; that as for themselves they had changed their mind, and intended to follow a small river which issued out of the lake, and went in a direction very different from the line of our journey.

* * *

We now entered the woods, and some time after arrived on the banks of another river that flowed from the mountain, which we also forded. The country, soon after we left the river, was swampy; and the fire having passed through it, the number of trees, which had fallen, added to the toil of our journey. In a short time we began to ascend, and continued ascending till nine at night. We walked upwards of fourteen miles, according to my computation, in the course of the day, though the straight line of distance might not be more than ten. Notwithstanding that we were surrounded by mountains covered with snow, we were very much tormented with musquitoes.

17th July.—Before the sun rose, our guides summoned us to proceed, when we descended into a beautiful valley, watered by a small river. At eight we came to the termination of it, where we saw a great number of moles, and began again to ascend.

* * *

We now gained the summit of the mountain, and found ourselves surrounded by snow. But this circumstance is caused rather by the quantity of snow drifted in the pass than the real height of the spot, as the surrounding mountains rise to a much higher degree of elevation. The snow had become so compact that our feet hardly made a perceptible impression on it. We observed, however, the tracks of an herd of small deer, which must have passed a short time before us, and the Indians and my hunters went immediately in pursuit of them. Our way was now nearly level, without the least snow, and not a tree to be seen in any part of it. The grass is very short, and the soil a reddish clay, intermixed with small stones. The face of the hills, when they are not enlivened with verdure, appears, at a distance, as if fire had passed over them. It now began to hail, snow and rain, nor could we find any shelter but the leeward side of a huge rock. The wind also rose into a tempest, and the weather was as distressing as any I had ever experienced.

* *

Before us appeared a stupendous mountain, whose snow clad summit was lost in the clouds; between it and our immediate course, flowed the river to which we were going. The Indians informed us that it was at no great distance,

* * * *

We continued our route with considerable degree of expedition, and as we proceeded the mountains appeared to withdraw from us. The country between them soon opened to our view, which apparently added to their awful elevation. We continued to descend till we came to the brink of a precipice, from whence our guide discovered the river to us, and a village on its banks. This precipice, or rather a succession of precipices, is covered with large timber, which consists ot the pine, the spruce, the hemlock, the birch, and other trees. Our conductors informed us, that it abounded in animals, which, from their description, must be wild goats. In about two hours we arrived at the bottom, where there is a conflux of two rivers, that issue from the mountains. We crossed the one which was to the left. They are both very rapid, and continue so till they unite their current, forming a treams of about twelve yards in breadth. Here the timber was also very large, but I could not learn from our conductors why the most considerable hemlock trees were stripped of their bark to the tops of them : I concluded indeed at tha time the inhabitants tanned their leather with it. Here were also the larges and loftiest elder and cedar trees that I had ever seen. We were now sensible of an entire change in the climate, and the berries were quite ripe The sun was about to set, when our conductors left us to follow them as wel as we could. We were prevented, however, from going far stray for w were hemmed in on both sides and behind by such a barrier as nature never before presented to my view; our guide had the precaution to mark th road for us, by breaking the branches of trees as they passed. This smal river must at certain seasons rise to an uncommon height and strength o current, most probably on the melting of the snow, as we saw a large quantity of drift wood lying twelve feet above the immediate level of the rive This circumstance impeded our progress, and the protruding rocks frequently forced us to pass through the water. It was now dark, without th least appearance of houses, though it would be impossible to have seen them if there had been any at the distance of twenty yards from the thickness of the woods. * * * *

July 18*th*.-- The water of this river is of the colour of asses' milk which I attributed in part to the limestone that in many places forms th bed of the river, but principally to the rivulets which fall from mountain of the same material. * * *

As we were still at some distance from the sea, I made application t my friend to procure us a canoe or two with people to conduct us thither

* * *

At one in the afternoon we embarked, with our small baggage, in tw canoes, accompanied by seven of the natives. The stream was rapid an ran upwards of six miles an hour. We came to a weir, such as I have already described, where the natives landed us, and shot over it withou taking a drop of water. They then received us on board again and we continued our voyage, passing many canoes on the river, some with peopl in them, and others empty. We proceeded at a very great rate for abou two hours and a half, when we were informed that we must land, as the village was only at a short distance. I had imagined that the Canadians wh accompanied me were the most expert canoe-men in the world, but the are very inferior to these people, as they themselves acknowledged, i conducting those vessels. * * *

July 19th.—At one in the afternoon we renewed our voyage in a large canoe with four of the natives. We found the river almost one continued rapid, and in half an hour we came to an house where, however, we did not land, though invited by the inhabitants. In about an hour we arrived at two houses, where we were, in some degree, obliged to go on shore, as we were informed that the owner of them was a person of consideration.

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We made our stay as short as possible, and our host embarked with us. In a very short time we were carried by the rapidity of the current to another house of very large dimensions, which was partitioned into different apartments, and whose doors were on the side. * *

The navigation of the river now became more difficult, from the numerous channels into which it was divided, without any sensible diminution in velocity of its current. We soon reached another house of the common size, where we were well received. * *

The inhabitants of the last house accompanied us in a large canoe. They recommended us to leave ours here, as the next village was but a small distance from us, and the water more rapid than that which we had passed. They informed us also that we were approaching a cascade: I directed them to shoot it, and proceeded myself to the foot thereof, where I re-embarked, and we went on with great velocity till we came to a fall, where we left our canoe and carried our luggage along a road through a wood for some hundred yards, when we came to a village consisting of six very large houses, erected on pallisades, rising twenty-five feet from the ground, which differed in no one circumstance from those already described, but the height of their elevation. * *

From these houses I could perceive the termination of the river, and its discharge into a narrow arm of the sea. As it was now half-past six in the evening, and the weather cloudy, I determined to remain here for the night, and for that purpose we possessed ourselves of one of the unoccupied houses. The remains of our last meal, which we brought with us, served for our supper, as we could not procure a single fish from the natives. The course of the river is about west, and the distance from the great village upwards of thirty-six miles. There we had lost our dog, a circumstance of no small regret to me. * *

July 20th.—At about eight we got out of the river, which discharges itself by various channels into an arm of the sea. The tide was out, and had left a large space covered with sea weed. The surrounding hills were involved in fog. The wind was at west, which was ahead of us, and very strong; the bay appearing to be from one to three miles in breadth.

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At two in the afternoon the swell was so high, and the wind, which was against us, so boisterous, that we could not proceed with our leaky vessel, we therefore landed in a small cove on the right side of the bay. Opposite to us appeared another small bay, in the mouth of which is an island, and where, according to the information of the Indians, a river discharges itself that abounds in salmon. * * *

When we landed, the tide was going out, and at a quarter past four it was ebb, the water having fallen in that short period eleven feet and a half

Since we left the river, not a quarter of an hour had passed in which we did not see porpoises and sea-otters. Soon after ten it was high water, which rendered it necessary that our baggage should be shifted several times, though not till some of the things had been wetted. We were now reduced to the necessity of looking out for fresh water, with which we were plentifully supplied by the hills that ran down from the mountains.

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July 21st.—As I could not ascertain the distance from the open sea, and being uncertain whether we were in a bay or among inlets and channel of islands, I confined my search to a proper place for taking an observation. We steered, therefore, along the land on the left, west northwest mile and a half; then northwest one-fourth of a mile, and north three mile to an island; the land continuing to run north northwest, then along th island, south southwest half a mile, west a mile and a half, and from thenc directly across to the land on the left (where I had an altitude) southwe three miles.* From this position a channel, of which the island we le appeared to make a cheek, bears north by east. * * *

We coasted along the land § at about west southwest for six miles an met a canoe with two boys in it, who were despatched to summon th people on that part of the coast to join them.

At some distance from the land a channel opened to us, at southwe by west, and pointing that way he made me understand that MACUBA came there with his large canoe. When we were in mid-channel, I pe ceived some sheds, or the remains of old buildings, on the shore; and a from that circumstance, I thought it probable that some Europeans mig have been there, I directed my steersman to make for that spot. Th traverse is upwards of three miles northwest.

We landed and found the ruins of a village, in a situation calculate for defence. The place itself was overgrown with weeds, and in the cent of the houses there was a temple, of the same form and construction that which I described at the large village. * * *

We had no sooner landed, than we took possession of a rock, whe there was not space for more than twice our number, and which admitte of our defending ourselves with advantage, in case we should be attacke

* * * * *

These men also told me that MACUBAH had been there, and left h ship behind a point of land in the channel, southwest from us, from whenc he had come to their village in boats, which these people represented b imitating our manner of rowing. * * * *

22nd July.— * * * The young man was now ver anxious to persuade our people to depart, as the natives, he said, were numerous as musquitoes, and of very malignant character. This inform tion produced some very earnest remonstrances to me to hasten ou departure; but as I was determined not to leave this place, except I wa absolutely compelled to it, till I had ascertained its situation, these solic tations were not repeated. * * *

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*The Cape or Point Menzies of Vancouver's.

§Named by Vancouver Kings Island.

In relating our danger, his agitation was so violent that he foamed at the mouth. Though I was not altogether free from apprehensions on the occasion, it was necessary for me to disguise them, as my people were panic-struck, and some of them asked if it was my determination to remain there to be sacrificed? My reply was the same as their former importunities had received, that I would not stir till I had accomplished my object.

* * * * *

My altitude by an artificial horizon, gave 52° 21' 33"; that by the natural horizon was 52° 20' 48" north latitude.†

* * * * *

I now mixed up some vermillion in melted grease, and inscribed in large characters, on the southeast face of the rock on which we had slept last night, this brief memorial,—"ALEXANDER MACKENZIE, FROM CANADA, BY LAND, THE TWENTY-SECOND OF JULY, ONE THOUSAND SEVEN HUNDRED AND NINETY-THREE."

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† This I found to be the cheek of Vancouver's CASCADE CANAL.

APPENDIX N.

Extracts from a Voyage of Discovery to the North Pacific Ocean in 1792 *and* 1793, *by* CAPTAIN GEORGE VANCOUVER, *submitted for the purpose o explaining the remarkable character of the Coast of British Columbi between latitude* 51° *and* 54°.—*For a copy of Vancouver's Chart, se sheet No.* 16.

July 27*th*, 1792.—Here the Chatham anchored, and Mr. Broughto pursued its eastern coast in his boat along the continental shore, leaving branch leading to the northward, near the entrance of which are tw islands and some rocks. This arm of the sea continued a little to th northward of east, 6 leagues, to the latitude of 50° 45', where its widt increased to near a league, taking an irregular northerly direction to it final termination in latitude 51° 1', longitude 234° 13'. To this, afte Capt. Knight of the Navy, Mr. Broughton gave the name of KNIGHT' CANAL. The shores of it, like most of those lately surveyed, are forme by high stupendous mountains rising almost perpendicularly from th water's edge. The dissolving snow on their summits produced many cat racts that fell with great impetuosity down their rugged, barren sides. Th fresh water that thus descended gave a pale white hue to the Canal, re dering its contents entirely fresh at the head, and drinkable for twent miles below it. This dreary region was not, however, destitute of inhab tants, as a village was discovered a few miles from its upper extremit which seemed constructed like that described in Desolation-Sound fo defence; the inhabitants were civil and friendly. * * *

July 28*th*.—We had not been long under weigh before we were joine by the Chatham, and steered to the northward for the channel leading t Deep Sea Bluff, which I called FIFE'S PASSAGE. As we crossed the mai arm the squally hazy weather permitted our seeing, but very imperfectl the several islands and rocks that it contains. About two o'clock in th afternoon we entered Fife's Passage, and found its eastern point (name by me, after Captain Duff of the Royal Navy, POINT DUFF), situate i latitude 50° 48', longitude 233° 10'. A small rocky islet lies off Poin Duff covered with shrubs; and off the west point of this passage, name POINT GORDON, bearing N. 83 W. from Point Duff, are several white fla barren rocks lying at a little distance from the shore. Although the tid appeared to be in our favor, we made so little progress in this inlet, tha we were compelled to anchor at five in the afternoon not more than tw miles within the entrance in twenty fathoms water, on the northern shore near some small rocky islets. The shores that now surrounded us wer not very high, composed of rugged rocks, steep to the Sea, in the chasm and chinks of which a great number of stunted or dwarf pine trees wer produced. * * * * * * *

July 31*st*.—From Deep Sea Bluff, the shore of the main, across this small opening, took a direction N. 50 W. for about four miles; then extended N.N.E., about a league to a point, where the arm took a more easterly course, passing an island and several rocky islets, forming passages for boats only; whilst, to the westward of the island, the main channel was a mile in width, and no doubt was entertained of our finding a greater depth of water than we required for the vessel. * * * *

We pursued the examination of this arm to its head in latitude 51° longitude 233° 46'; when it terminated in a similar way to the many before described. Its shores, about a mile apart, were composed of high, steep craggy mountains, whose summits were capped with snow; the lower cliffs though apparently destitute of soil, produced may pine trees, that seemed to draw all their nourishment out of the solid rock. The water, near four leagues from its upper end, was of a very light chalky colour, and nearly fresh. From its shores two small branches extended, one winding about four miles to the S. E. and S. W., the other about a league to the N. N. W. * * * * * * * *

August 1*st*.—We kept the continental shore on board through a very intricate narrow branch that took a direction E. by N. for near two leagues, and then terminated as usual, at the base of a remarkable mountain, conspicuousfor its irregular form, and its elevation above the rest of the hills in its neighbourhood. This I have distinguished in my chart by the name of Mount Stephens, in honor of Sir Philip Stephens of the Admiralty. It is situated in latitude 51° 1', longitude 233° 20', and may serve as an excellent guide to the entrance of the various channels with which this country abounds. * * * * *

The narrow possage by which we had entered, is a channel admissable for boats only; and thence to the foot of Mount Stephens, was merely a chasm in the mountains, caused, probably, by some violent efforts of nature. This idea originated in its differing materially in one particular from all the canals we had hitherto examined; namely, in its having regular soundings, not exceeding the depth of 13 fathoms, although its shores, like all those of the bottomless canals, were formed by perpendicular cliffs, from their snowy summits to the water's edge. The stupendous mountains on each side of this narrow chasm, prevented a due circulation of air below, by excluding the rays of the sun; whilst the exhalations from the surface of the water and the humid shores of the canal, wanting rarefication, were, in a great measure, detained, like steam in a condensed state; the evaporation thus produced a degree of cold and chillness which rendered our night's lodging very unpleasant. * * * *

August 5*th*.—By this expedition, the continental shore was traced to the western-most land in sight. We had now only to proceed along it, as soon as the wind and weather would permit our moving. This, however, a thick fog and a calm prevented, until Sunday afternoon, when a light breeze between S. W. and West, enabled us, by sunset, to advance about two leagues to the westward of Point Boyles, which, by compass, bore from us S. 85 W. * * * * * * *

Between this point and a cluster of islands, bearing west, a channel appeared to lead along the coast of the Main land, in which were some small islets and rocks; south of the cluster, the haze and fog rendered it impossible to determine of what that region principally consisted, though the imperfect view we obtained, gave it the appearance of being much broken. In this situation, we had 60 and 70 fathoms, muddy bottom, but as we had sufficient space to pass the night in under sail, I preferred so doing, that we might be the more ready to pursue the above mentioned channel in the morning. * * * * * *

August 6th.—The fog had no sooner dispersed, than we found ourselves in the channel for which I had intended to steer, interspersed with numerous rocky islets and rocks, extending from the above cluster of islands towards the shore of the continent. The region to the S. W. still remained obscured by the fog and haze; at intervals, however, something of it might be discerned, serving only to shew there was no great probability of our finding a less intricate passage to navigate, than that immediately before us along the continental shore. * * * *

August 7th.—The rocks between our present anchorage and the Ocean having the appearance of being almost impenetrable, Mr. Whidbey was dispatched to discover the most safe channel for us to pursue. The day-light just served him to execute his commission; and on his return at night he informed me, that there were three passages: one nearly through the center of the rocks; another about midway between the continental shore and a very broken country to the southward of us; and a third between the nearest cluster of rocks and the continent. This for a small distance seemed to be clear, but further to the northwestward a labyrinth of rocks appeared to stretch, from the continent towards the land, forming like two islands. These rocks nearly joined to the north easternmost about 9 miles from us, bearing by compass N. 50 W., the westernmost at about the same distance, N. 64 W. The nearest cluster of rocks, whose southern part was almost in a line with the easternmost island, not quite a league from us, we were to pass to the south of, between them and other rocks and rocky islets, to the westward and S. W., forming a channel about two miles wide, in which no visible obstruction had been discovered by Mr. Whidbey. These rocks and rocky islets presented an appearance of being as nearly connected with the southern broken shore, as those further north did with the continent, giving us little to expect but a very intricate and hazardous navigation. * * * * * * * *

August 9th—We now appeared to have reached the part of the Coast that had been visited and named by several of the traders from Europe and India. The Experiment, commanded by Mr. S. Wedgborough, in August, 1786, honored the inlet through which we had lately passed, with the name of "QUEEN CHARLOTTE'S SOUND;" the opening on the continental shore was discovered, and called "SMITH'S INLET" by Mr. James Hanna, the same year; the high distant mountain that appeared to be separated from the main land, formed part of a cluster named by Mr. Duncan "CALVERT'S ISLANDS;" and the channel between them and the main land, was, by Mr. Hanna, called "FITZHUGH'S SOUND." These being the names given, as far as I could learn, by the first discoverers of this part of the coast, will be continued by me, and adopted in my charts and journal. * *

August 10*th.*—Having a fine breeze from the eastward on Friday morning, we weighed at seven, and stood across Queen Charlotte's Sound for the entrance of Smith's Inlet. The Chatham being ordered to lead, at half-past ten made the signal for soundings, at the depth of 10 to 18 fathoms. In this situation the island, near which the Chatham had grounded, bore S. 43 E. distant about 6 or 7 leagues; and the labyrinth of rocks that before had appeared to extend along the continental shore, now seemed to exist no further than a low sandy point bearing by compass E. S. E. at the distance of about two leagues. The shore of the main from this point seemed free from rocks, and possessed some small sandy bays to the south point of entrance into Smith's Inlet, which bore by compass N. 18 W. about a league distant; where detached rocks were again seen to encumber the shore. The weather, less unfavourable to our pursuits than for some time past, permitted our having a tolerably distinct view of the surrounding country. The opening before us, Fitzhugh's Sound, appeared to be extensive in a northerly direction. At noon we found our observed latitude to be 51° 21', longitude 232° 4'. In this situation, the south point of Calvert's Island bore by compass N. 29 W. its westernmost part in sight N. 60 W. two clusters of rocks, S. 73 W. and N. 70 W. these were discovered by Mr. Hanna, who named the former "VIRGIN," the latter "PEARL ROCKS," both which being low, and at some distance from the shore, are dangerously situated. The south point of Smith's Inlet terminating the continental shore in a northwesterly direction, bore by compass S. 40 E. from which the "Virgin" rocks, about thirteen miles distant, lie N. 75 W.and the "Pearl rocks" N. 38 W. distant about eight miles.

With intention of continuing the investigation of the continental shore up Smith's Inlet, the "Chatham" was directed that way; but, as we advanced, the great number of rocky islets and rocks, as well beneath as above the surface of the sea, and the irregularity of the soundings, induced me to abandon this design, and to steer along the eastern side of Calvert's Island, forming a steep and bold shore, in quest of Port Safety, laid down in Mr. Duncan's Chart, or of any other convenient anchorage we might find; and from thence to dispatch two parties in the boats, one to prosecute the examination of the broken shores to the south-eastward of us, the other to explore the main branch of Fitzhugh's Sound, leading to the northward. In consequence of this determination, the necessary signal was made to the "Chatham" for quitting her pursuit; and we made all sail to the northward.

On passing that which we had considered as the south point of Calvert's island, it proved to be two small islets lying near it; and from the southernmost of them, the Virgin and Pearl rocks in a line lie S. 68 W. the former eleven, and the latter four miles distant.

As we proceeded up this sound. the eastern shore still continued to be much divided by water; towards the sea it was of moderate height, though the interior country was considerably elevated; the whole was apparently one entire forest of pine trees produced from the chasms in the rugged rocks of which the country is formed. The western, or shore of Calvert's island is firm, and rose abruptly from the sea to a very great height, seemingly composed of the same rocky materials, and like the eastern shore, entirely covered with pine trees.

August 11*th*.—About four in the afternoon a small cove was discovered on the western shore, bearing some resemblance to Mr. Duncan's Port Safety, but differing in its latitude acccording to our run since noon. Appearing, however, likely to answer all our purposes, we hauled in for it; the shores we found to be bold, steep on either side, and soundings at the entrance were from 23 to 30 fathoms, soft bottom. We anchored about six in the evening in 17 fathoms on the south side of the cove, as did the Chatham on the opposite shore, steadying the vessels with hawsers to the trees. My first object after the ship was secured, was to examine the cove. It terminated in a small beach, near which was a stream of excellent water and an abundance of wood; of these necessaries we now required a considerable supply; and as the field of employment for our boats would be extensive, there was little doubt of our remaining here a sufficient time to replenish these stores. Being tolerably well sheltered in this cove, I was willing to hope the Chatham might with security, and without much difficulty, be laid on shore to examine if she had sustained any damage whilst striking on the rocks. * * * * * * *

Our separation had scarcely taken place, when our southerly breeze freshened to a brisk gale, attended by a torrent of rain. The wind, however, having favored our pursuit, we reached the eastern shore about five miles to the northward of the cove where the ships rode. It was low but compact, with one small opening only, impassable for our boats by breakers extending across it. On the western side two conspicuous openings had been observed; the southernmost had the appearance of being a very fine harbour; the other, about two leagues further north, formed a passage to sea, in which were several rocky islets About noon we arrived at the point where Mr. Johnstone's researches were to commence, nearly in the direction of north from the ships, and at the distance of about 16 miles. From this point, the north point of the passage leading to sea, lies S. 39 W. 4 miles distant; but the thick rainy weather prevented our seeing any objects that were to the northward. * * * *

*August*12*th*.—We resumed our examination along the starboard or continental shore, extending from the above point about a league and a half in a north direction. Here the inlet divided into two capacious branches; that appearing to be the principal one still continued its northerly course, the other stretched E. N. E. and was in general about a mile wide. In order to prosecute the survey of the continental shore, which I presumed this to be, the latter became the first object of our examination, for which we quitted the former, whose width we estimated at a league. * * * * * * * Here the mountains which appeared to be a continuation of the snowy barrier from Mount Stephens, retired a small distance from the beach, and the low land, occupying the intermediate space, produced pine trees of inferior growth, from a bed of moss and decayed vegetables in the state of turf, nearly as inflammable as the wood which it produced. A continuation of the unpleasant weather confined us to this uncomfortable spot until Monday afternoon; when about four we again proceeded up the branch, which from the from the beach, took a direction N. by E.; the furthest point seen in that line, was at the distance of about 3 leagues; this, after passing an extensive cove on the starboard side, we reached about nine at night. Excepting this cove, and that we had departed from, none other was seen, the sides of this canal being composed of compact stupendous mountains, and nearly perpendicular rocky cliffs, producing pine trees to a considerable height above the shores, and then nearly barren to their lofty summits, which were mostly covered with snow.

August, 14*th*.—During the night we had much rain; the next morning the weather was cloudy, with some passing showers, which at intervals enabled us to obtain a tolerably distinct view of the region before us; and for the first time since the commencement of this expedition, it showed the branch we were navigating to be about two miles wide, extending in a N. E. by E. direction, several leagues ahead. * * * *

By noon we had reached the entrance of this branch of the inlet, where, on a small islet near its south point I observed the latitude to be 51° 52', making the station at which I had parted with Mr. Johnstone, and which I had concluded to be the continental shore, in latitude 52° 3', longtitude 232° 19'. This rendezvous was about 37 miles from the station of the vessels, in as desolate, inhospitable a country, as the most melancholy creature could be desirous of inhabiting. The eagle, crow and raven, that occasionally had borne us company in our lonely researches, visited not these dreary shores. The common shell fish, such as muscles, clams and cockles, and the nettle, samphire and other coarse vegetables, that had been so highly essential to our health and maintenance in all our former excursions, were scarcely found anywhere here to exist; and the ruins of our miserable hut, near where we had lodged the preceding night was the only indication we saw that human beings ever resorted to the country before us, which appeared to be devoted entirely to the amphibious race; seals and sea otters, particularly the latter, were seen in great numbers.

August 18*th*.—The entrance into Smith's Inlet, was nearly closed by rocky Islets, some producing shrubs and small trees, others none; with innumerable rocks, as well beneath as above the surface of the sea, rendering it a very intricate and dangerous navigation for shipping. Within the islets and rocks, the northern shore appeared the clearest; but the opposite side could not be approached without some difficulty, not only from the numerous rocks, but from a great oceanic swell occasioned by the prevailing tempestuous weather. From the entrance into the inlet, whose north point lies from its south point N. 20 E., about a league distant, they found it extends, nearly in an east direction, about six leagues; here it took a turn to the north eastward, and terminated in latitude 51° 24', longtitude 232° 47½'. About 3 leagues within the entrance, the rocks and islets ceased to exist, and the inlet contracted to a general width of about half a mile; though in particular places, it was near twice that distance from shore to shore; both of which were formed by high rocky precipices covered with wood. About half way up the canal a village of the natives was discovered, which our gentlemen supposed might contain two hundred or two hundred and fifty persons. It was built upon a detached rock, connected to the main by a platform, and like those before mentioned, constructed for defence. * * * * * *

On the 16th they entered another opening, about a league to the north of the north point of Smith's Inlet. The entrance into this seemed less dangerous than the former; it had, however, on its southern side, many rocky islets and rocks; but they discovered no one below the surface of the water, nor any danger that could not easily be avoided; and, by keeping on the north side of the entrance, which is about half a league across, a fair navigable passage was found about half a mile wide, between the north shore and the rocky islets that lie off its southern side. Along this the Continent was traced about a league, in an east direction, where the opening took its course N. 15 E., about 16 miles, and terminated in latitude 51° 42', longitude 232° 22'. About a league and a half south of this station, a small branch extends about four miles to the W. N. W.; and, half a league further south, another stretches about the same distance to the N. E.

In this inlet, which I have distinguished by the name of RIVER'S CANAL, the land continued of a more moderate height further up than has generally been found to be the case; but where it branched off in the above directions towards its head, the shores were composed of high, steep, rocky mountains, and, like Smith's Inlet and many other canals of this kind that we had examined, afforded no soundings in the middle, with 80 fathoms of line; though in the bays, found in most of these Canals, anchorage may, in all probability, be procured. Having finally examined these branches, they returned by a very narrow intricate channel on the northern shore, leading through an immensity of rocky islets and rocks, until they reached POINT ADDENBROOK, and again arrived on the eastern shore of Fitzhugh's Sound; making the land they had passed, in going up this last inlet, on their larboard side, an island about six or seven miles long. * * *

Since my return from the last boat expedition, I had fortunately obtained, during the few short intervals of fair weather that had occurred, some tolerably good observations for the latitude and longitude of this station. The former, by three meridional altitudes of the sun, appeared to be 51° 32', the latter, 232° 3' 15": the variation of the compass 17° 7' eastwardly. This cove is at its entrance, the points of which lie from each other N. 30 W. and S. 30 E, about a quarter of a mile wide; and from thence, to its head, in a direction S. 68 W. about a mile. A small rock and two rocky islets lie off its north point of entrance. * * * *
Hence I have distinguished it by the name of SAFETY COVE; and have only further to add, that the rise and fall of the tide was about ten feet, and that it is high water at the time the moon passes the meridian. The same circumstances respecting the tides were observed by those employed in the boat excursions from this station.

August 19*th*.—In the morning of the 19th, we sailed out of Safety Cove, having, for the first time since the commencement of the present month, a pleasant breeze from the S. E. with serene and cheerful weather. About eleven o'clock we had the gratification of being joined by our other boat party; and from Mr. Johnston I learned, that about 4 miles to the N. E. of the spot where I had quitted them, they pursued a narrow branch of the inlet winding to the south and south-westward, to the latitude of 51° 57', due south of the place of our separation. The inclemency of the weather detained them in this situation until the 16th, when they pursued the main branch of the inlet, which is from one to two miles broad, in a north-easterly direction, to a point which I called by the name of POINT MENZIES, after Mr. Menzies who had accompanied me, and afterwards Mr. Johnstone, in this excursion; here the inlet divides into three branches, each nearly as wide as that they had navigated. The first led to the N. W., the second to the northward, and the other to the south. Several leagues to the S. W. of Point Menzies, the water had assumed a pale white colour, and was not very salt, which had encouraged them to push forward in constant expectation of finding its termination; but on reaching the above station, all hopes entirely vanished of carrying their researches further into execution, having extended their excursion beyond the time I had prescribed, and the period for which they had been supplied with provisions. These on the morning of the 17th, being nearly expended, Mr. Johnstone considered it most prudent to decline any further investigation, and to return to the ships. These they reached two days afterwards, almost exhausted with hunger and fatigue.

Voyage of Discovery Continued in 1793.

May 25th.—This was the most westerly projecting part of the continent in this neighbourhood; from whence the shores of the mainland take a N.N.E and south-eastwardly direction, and make it a conspicuous cape, terminating in rugged, rocky, low hummocks, that produce some dwarf pine and other small trees and shrubs. This cape, from the dangerous navigation in its vicinity, I distinguished by the name of CAPE CAUTION; it is in latitude 51 ° 12', longitude 232 ° 9'. * * * * *

The south point of Calvert's Island being in latitude 51 ° 27', longitude 232 ° 5', was found to be correctly placed. The variation of the compass allowed in this situation was 18 ° eastwardly.

Soon after noon some very dangerous breakers were discovered, over which the sea, at long intervals of time, broke with great violence. * *

Their eastern part lies from Cape Caution, N. 72 W., distant about 5 miles; but the rocks that lie off the shore to the northward of the Cape, reduce the width of the channel between them and the breakers to about a league, through which we passed without noticing any other obstruction that was not sufficiently conspicuous to be avoided.

May 26th.—With a gentle breeze from the E. N. E., we stood up Fitzhugh's Sound in the evening, with all the sail we could spread. This, by four the next morning, brought us opposite to the arm leading to Point Menzies, whose extent was left undetermined, and where, in a cove on the south shore, about eight miles within its entrance, I expected to join the Chatham; but the wind being unfavourable, and the ebb tide setting out, we made little progress until six o'clock, when we worked up the arm with the flood tide, and a light easterly breeze, attended with much rain, and thick misty weather. * * * * *

As many necessary repairs in and about the Discovery demanded our immediate attention, and that no time might be lost; I determined that, while those on board were employed on the requisite duties, two boat parties should be dispatched to prosecute the examination of the broken region before us. * * * * * *

On the 29th Mr. Johnstone was dispatched in the Chatham's cutter attended by our small one, to finish the examination of this inlet, which he was prevented doing last year, by the badness of the weather. The next morning, accompanied by Lieutenant Swaine in the cutter, I set out in the yawl to examine the main arm of this inlet, that appeared to take its direction northerly to the west of, or without, the arm in which the ships were at anchor. This, after the Right Honorable Edmund Burke, I named BURKE'S CANAL. * * * * *

About nine in the forenoon we arrived in what appeared to be the main branch of the inlet, leading to the north from Fitzhugh's Sound. After a much-respected friend, I named this FISHER'S CANAL. Some detached rocks were passed, that lie N. 14 W., about a league from the north-west point of entrance into Burke's Canal, which obtained the name of POINT WALKER; it is situated in latitude 51° 56½', longitude 232° 9'; its opposite point of entrance, named POINT EDMOND, lies from it S. 60 E., near two miles. Off Point Edmund lie several rocky islets: with one on the opposite shore, a little within Point Walker; but the channel is fair to navigate.

We had a fresh southerly gale in our favor, but the cloudiness of the weather prevented my obtaining an observation for the latitude. For this purpose, though we did not succeed, we landed on some rocks near the western shore; * * * * * *

From these rocks we steered over to the opposite shore, the canal being from a mile to half a league wide. The eastern, almost a compact shore, lies in a north direction, to the south point of a small opening, in latitude 52° 6½'; this extended E. by N. four miles, and terminated as is usual with the generality of these branches. Its north point of entrance lies from its south point N. 14 E., distant two miles. Before its entrance are two small islands, and towards its northern shore are some rocks. This opening formed a good harbour, and was by me named PORT JOHN. From the north point the eastern coast still continued nearly in its former direction for two miles and a half, and then took a more eastwardly bend. The country we had passed along, since we had entered Fisher's Canal, might, on the western side, be considered of a moderate height; its surface, composed principally of rocks, was uneven, and full of chasms, where a soil, formed by the decay of vegetables, produced some different sorts of pine trees of slender growth, the maple, birch, small-fruited crab, and a variety of shrubs, and berry bushes. The eastern shore rose more abruptly, and was bounded behind by very lofty rugged mountains covered with snow.

As we proceeded along the eastern shore, we passed, and left for future examination, an opening on the opposite shore, that took a N. N. W. direction, and was of such considerable extent as to make me doubtful whether it might not be the main branch of the inlet. Agreeably, however, to my former practice, we kept the starboard shore on board, as the most positive means of ascertaining the continental boundary; and as we advanced, the land to the northeast of the above opening, forming the northwest side of the canal, rose to an equal, if not a superior height, to that on the southeast side.

The evening was very rough, rainy, and unpleasant, and what contributed to render our situation more uncomfortable was the steep precipices, that constituted the shores, not admitting us to land until near midnight; when with difficulty we found room for erecting our tents, that had been constructed on a small scale for the convenience of this service.

Friday 31*st*.—During the night we had a heavy fall of rain, and at day-light the next morning our lodging was discovered to have been in a morass, and most of our things were very wet. In this very unpleasant abode we were detained by the weather until eight o'clock, when, although the rain continued, the haze cleared sufficiently to allow of our proceeding northward to a point on the opposite shore, situated in latitude 52° 14½', longitude 232° 12½'; where the channel divided into two branches, one leading to the N. N. E., the other N. 63 E. The latter, for the reasons before given, became the object of our pursuit. From Mr. Johnstone's sketch the preceeding year, and from the direction this branch was now seen to take, we had some reason to suppose the eastern land was an island. Towards noon the weather enabled me to get an indifferent observation for the latitude, which showed 52° 19'. The inlet now extending to the northeastward was generally about a mile wide, the shores steep, rocky, and compact, if a small opening, or sheltered bay, on the southeast shore be excepted. In the afternoon two openings on the northwest shore were passed. The northernmost of these had the appearance of being extensive. At its south point of entrance in latitude 52° 23½', longitude 232° 28½', we met with a small party of the natives, whose appearance and conduct much resembled those we had met the day before. They strongly solicited us to visit their houses; but as their signs gave us reason to believe their habitations were behind us, though at no great distance, I declined their civil intreaties, and prosecuted our survey until seven in the evening, when we arrived at a point, from whence the inlet again divides into two arms, one taking a northerly, the other a southeasterly direction. From this point, named by me POINT EDWARD, situated in latitude 52° 25½', longitude 232° 37½', and forming the northern extremity of the eastern shore, we directed our route to the southeast, in order to take up our lodging for the night, having little doubt of finding that channel to be the same that Mr. Johnstone had the last year left unexplored, extending to the northward.

June 1*st*.—About four o'clock the next morning, the weather being mild, though cloudy, we again prosecuted our researches to the south-east, and about seven came to a point that left no doubt as to our situatian, and that the starboard shore which we had thus far pursued, was one side of an extensive island, which I distinguished by the name of KING'S ISLAND, after the family of my late highly-esteemed and much lamented friend, Captain James King of the navy. Point Menzies was seen from this station lying S. 83 E., about 3 leagues distant, and the north-east point of Burke's canal on the opposite shore S. 78 E., two miles and a half distant. The continuation of the inlet to the eastward was evidently the same that had undergone the examination of Mr. Johnstone, and determined to a certainty that we had the continent again in view. * * *

The weather was now serene and pleasant. With a gentle south west breeze, after breakfast, we continued to examine the north east branch, and at noon I observed the latitude in its entrance to be 52° 19' 30"; whence point Menzies will be found to be in 52° 18' 30"; being 4' further north than the latitude assigned to that point on our former visit; but its longitude did not appear to require any correction. * * *

The appearance of the country we had passed by varied in no respect from what has already been frequently described, excepting that the maple, birch, crab, and other small trees, seemed to be more numerous and or a larger size. Two or three whales, one near Point Menzies, several seals, and some sea otter had been seen; these were remarkably shy, as were two black bears that were observed on the shores. * * *

June 2nd.—Early the next morning, with rainy, unpleasant weather, we again proceeded, keeping the starboard or continental shore on board, to the fifth unexamined opening, lying from Point Edward, on King's Island, nearly north, about 6 miles; in general a mile, but sometimes a league wide.

We passed an islet and some rocks lying on the eastern or starboard shore, where we breakfasted, and afterwards continued our researches until about two o'clock, when we stopped to dine in a bay on the western shore, into which flowed the most considerable rivulet I had yet seen in this country. The tide was then at the lowest, yet it admitted our boats into its entrance, which is about thirty yards wide and four feet deep, and discharged a rapid stream of fresh water until prevented by the flood tide The spring tides appeared to rise about seven feet. High water 11h. 10m. after the moon passes the meridian. This brook soon decreased in dimensions within the entrance, and shortly lost itself in a valley, bounded at no great distance by high perpendicular mountains.

June 3rd.—From hence we proceeded about 9 miles up the arm, still extending to the northeast, and preserving the same width. We passed a small island lying near the western shore; here we took up our abode for the night, and the next morning again proceeded. The water wa nearly fresh at low tide, but was not of a very light colour. Having gone about a league we arrived at a point on the western shore, from whenc the arm took a direction N. N. W. for about 3 leagues, and then, as wa most commonly the case, it terminated in low marshy land. * *

After breakfast we returned by the same route we had arrived, an stopped at the point above mentioned to observe its latitude, which I foun to be 52° 43½', and its longitude 232° 55'. To this point I gave the nam of POINT RAPHOE, and to the canal we had thus explored, DEAN'S CANAL Quitting this point, we dined on our return at the same brook where w had stopped the preceding day. * * * *

June 4th.—From thence we proceeded towards the next unexplore inlet, until near dark, when we halted again for the night, and on th following morning reached its entrance about half a mile wide, lying in N. 50 W. direction. The weather was rough, chilly, and unpleasan attended with much rain until noon. At this time we had reached withi a mile of the head of the arm, where the observed latitude was 52° 32 longitude 232° 17'; this terminated like the others, and we returned b the same route we had come.

The width of this canal did not anywhere exceed three quarters of a mile; its shores were bounded by precipices much more perpendicular than any we had yet seen during this excursion; and from the summits of the mountains that overlooked it, particularly on its north-eastern shore, there fell several large cascades. These were extremely grand, and by much the largest and most tremendous of any we had ever beheld. The impetuosity with which these waters descended produced a strong current of air that reached nearly to the opposite side of the canal, though it was perfectly calm in every other direction. At first I considered these cascades to have been solely occasioned by the melting of the snow on the mountains that surrounded us; but, on comparing them with several smaller falls of water, which, by their colour, by the soil brought down with them, and other circumstances, were evidently produced from that temporary cause; but the larger torrents appeared to owe their origin to a more general and permanent source. This arm I distinguished by the name of CASCADE CANAL. * * * * *

June 5th.—Our visit here detained us about half an hour, after which we proceeded to the third unexplored opening. This was about S. 52 W. and about a league distant from the south point of Cascade Canal; here we rested, and in the morning of the 5th, found it terminate about 2 miles in a westerly direction. From thence we proceeded to the next arm; this was the first we had noticed to the eastward of that, of which on the 30th of May I had entertained doubts of its being the main branch of the inlet. We are now favored with pleasant weather, and a gentle gale from the N. E. and S. E. This, by noon, brought us within about a mile of the arm's termination, which, from its entrance in a N. N. E. direction, is about 5 miles; here I observed the latitude to be 52° 19', the longitude 232° 13½'. This branch finished in a similar manner with the many others, though its shores were not so steep, nor did they afford such falls of water as were seen in Cascade Canal. From hence we continued along the continental shore until the evening, when we reached the doubtful opening, and found its entrance to be in latitude 52° 12', longitude 232° 7'; it is about three quarters of a mile wide, and has a small islet and several rocks extending from its north-east point. Between these rocks and the western shore there appeared to be a fair navigable channel.

About a mile up this opening on the starboard, or continental shore, we remained during the night on an insulated rock, that had formerly been appropriated to the residence of the natives. It forms the north point of entrance into a cove, where a sunken rock lies, not visible until half tide; within this rock is a clear sandy bottom, that might be found convenient for the purpose of laying small vessels aground to clean or repair, as we estimated the tide, though not near the height of the springs, to rise fourteen or fifteen feet, and to be high water at the time the moon passes the meridian. We were detained at this station by thick, foggy, and rainy weather, attended with a strong south-east gale, until ten o'clock in the forenoon of the 6th, when the fog in some measure clearing away, we proceededin our researches up this arm. It lies in a general direction of N. 20 W. for about 3 leagues; the eastern or continental shore is steep and compact; but, on the western shore, we passed, five or six miles within the entrance, five rocky islets producing some trees, and admitting a passage for boats between them and the shore; and on the same side, about seven miles within the entrance, is a larger islet, having between it and the shore a rock; on which was an Indian village that contained many houses, and seemed to be very populous.

* * * * * *

Our route, however, lying wide of either their village or their retirement we did not increase their apprehensions by approaching nearer to them but continued our survey up the arm, that still took a northerly direction leaving on the western shore a spacious opening extending to the westward and passing a small island covered with pine trees, that lies nearly in mid channel of the arm we were pursuing.

Having reached, about two in the afternoon, a point on the eastern shore, about 10 miles from the entrance, we stopped to dine, and were here visited by some Indians from the village in two canoes.

* * * * * * * * *

From this point we found the arm take first a direction N. 40 E. near a league, and then N. 30 W. about 5 miles further; it was in general from hal to three quarters of a mile wide, and terminated as usual in low swampy land, in latitude 52° 28½', longitude 232° 4'. From hence we returned and halted for the night, about 2 miles from its head on the western shore.

June 7th.—The next morning we proceeded to the branch leading to the westward, that we had passed the preceding day; and about eigh o'clock reached a small island lying near the northern shore, about two miles to the westward of its entrance, situated in latitude 52° 19¾', longitude 232° 1'.

* * * *

The weather became serene and pleasant, with a gentle breeze from the southwest. We now quitted the high, steep, snowy mountains, composing the shores we had lately traversed; for the sides of the opening before us, comparatively speaking, might be considered as land of moderate height. Its surface, covered with wood, was very uneven, and being very similar to the general appearance of the land near the sea coast, gave u reason to believe this channel would lead towards the ocean. The continental shore had been accurately traced to our present station, and th communication of this channel with the ocean became an object I much wished to ascertain, before the vessels should be removed further into thi interior and intricate navigation; well knowing the tardy and disagreeabl progress in so doing. To effect this purpose in the best manner I was able, I continued to trace the channel leading westward, passing by on the starboard or continental shore, an opening that appeared to terminat in a spacious bay, at the distance of about two miles. Another openin was seen immediately to the westward of this bay, that appeared of considerable extent, leading to the N. N. W., and had two small islands nearl in the centre of its entrance; but, as we had now been nine days from th ship, our stock of provisions was too much reduced to admit of our undertaking further examinations, especially as every foot we advanced we ha additional reasons for supposing we should find a channel in this neighbourhood that would lead to the ocean. From the last opening the coas trended S. 40 W; in which direction I well knew we could not lon continue without meeting the sea; and having proceeded thus about league, I stopped about noon at a point on the northwest shore to observe the latitude, which was 52° 17', longitude 231° 54'; and whilst I was so employed, Mr. Swaine was sent forward, with directions, on his discovering a clear channel to sea, to return. As I was preparing to follow him, the cutter was seen coming back; Mr. Swaine reported that from a point lying S. 48 W., a mile and a half from our station, he had seen the ocean in a direction S. 70 W.; the furthest land being about 3 or 4 leagues distant.

Being now satisfied that all the land forming the sea coast, from the south entrance into Fitzhugh's Sound, to the place from whence we now looked into the ocean, consisted of two extensive islands, that were again probably much sub-divided; I considered the object of our errand accomplished, and we sat off on our return towards the station of the vessels, from whence we were 45 miles distant. * * * * * *

The next morning Mr. Johnstone informed me that on the forenoon of the 30th of May he reached Point Menzies, from whence he found an arm lying in a direction with little variation S. 33 E. By noon they had advanced about 5 miles from Point Menzies, where the latitude was observed to be 52° 15', and about 4 miles further passed an island on the eastern shore. The weather being pleasant, great progress was made until the evening, when they reached its termination in latitude 52° 1', longitude 233° 18'. Its width in general a little exceeded a mile, and the surrounding country exactly resembled that which we had found contiguous to those branches of the sea that have been so repeatedly described. * * *

From this curious place of residence Mr. Johnstone came back along the eastern shore, and about five miles from the termination of the canal, he observed the latitude to be 52° 4'. About seven the next morning (1st of June) the arm leading to the northeastward was entered; this was found about 1 mile and a quarter wide, lying in a direction of N. 62 E. from its north point of entrance; and, at the distance of eleven miles, it terminated in the usual way, in the latitude 52° 26', longitude 233° 16'. Here was another habitation of the same sort. Having now completed the examination of this branch, the party returned along its northern shores, and at the point of entrance Mr. Johnstone found my directions to return to the vessels, which they reached in the forenoon of the next day. In their way they saw several bears; two young cubs were killed, and proved excellent eating. * * *

June 10*th*.—In the afternoon we weighed and towed out of the cove, which I distinguished by the name of RESTORATION COVE, having there passed and celebrated the anniversary of that happy event. * * *

This uninteresting region afforded nothing further worthy of notice, excepting the soundings, the dimensions of the cove, and the very few astronomical and nautical observations, that, under the unfavorable circumstances of the weather, could be procured. The breadth of the cove at the entrance, in a north and south direction, is about a mile and a quarter, and its depth, from the centre of the entrance in a northeast direction, is three-quarters of a mile. The soundings, though deep are regular, from 60 fathoms at the entrance, to 5 and 10 fathoms close to the shore. The land on the opposite side of the arm is about two miles and a half distant. * * *

The northwest point of entrance into Milbank's Sound, now bore by compass S. 16 W., and the southeast point, named after the third lieutenant of the Discovery, CAPE SWAINE, S. 13 E.; in this direction was a small island about two miles and a half from us; and from that island S. 14 W., at the distance of about half a league, lies a very dangerous sunken rock. We passed to the westward of these, but the Chatham went between them and the eastern shore, which still continued broken and rocky, forming a passage with the above sunken rock and breakers about half a mile wide, where the soundings were found to be very irregular. On the western shore an opening was seen extending N. 88 W., having the appearance of leading to the sea, with two very large low flat rocks lying before it; the nearest shore was on that side, and bore W. N. W. at the distance of a mile.

Cape Swaine was found by our observations to be in latitude 52° 13', longitude 231° 40'; and the northwest point of entrance into Milbank's Sound, which I called Point Day, off which lie several barren rocky islets, in latitude 52° 14½', longitude 231° 27'; being in point of latitude, 15' to the south of the situation assigned to it by Mr. Duncan, and who considers its longitude to be 50' to the westward of our calculations. As the day advanced, the southwestwardly breeze freshened with pleasant weather. The Chatham was directed to lead, and by four in the afternoon, having reached the extent of Mr. Johnstone's researches, we directed our route up a channel about a mile wide, leading to the northwestward, whose entrance from Milbank's Sound is situated in latitude 52° 47', and longitude 231° 37'. As we advanced in a direction from its entrance N. 55 W., the channel narrowed to about a fourth of a mile, and having proceeded about 4 miles, the Chatham suddenly found only 6 fathoms water, on a shoal stretching from the starboard or continental shore into mid-channel; this we passed on the opposite side in 18 and 20 fathoms water. Beyond this, which is the narrowest part of the channel, formed by a high round projecting part of the southwest shore, appearing like an island; the arm widened to near half a league, and an extensive opening, taking a southerly direction, indicated a communication with the ocean.

The wind continuing favorable, and the weather pleasant, we made a tolerably good progress along the continental shore until about nine in the evening, when we anchored in 58 fathoms water, within about half a cable's length of the south point of an opening leading to the eastward, where the tides were very strong and irregular. The region we had been navigating since noon, had gradually increased in its elevation, and we were again encompassed by high, steep, rocky, snow-capped mountains, forming various chasms, and producing a forest of pine trees nearly to their very summits.

* * * * * * *

June 27th.—About noon on the following day Mr. Johnstone returned and communicated the following particulars of his excursion. The western branch he found to extend N. 55 W. about 12 miles, where it united with two extensive arms, one leading nearly north, the other about west. The western one continued about 2 leagues, where it united with two other branches more extensive than the former, one taking a southerly, the other a northwesterly direction. The first of these was pursued, and having by noon of the 23rd advanced about 2 leagues, the latitude was observed on the larboard side to be 53° 11', longtitude 231° 3'; the variation of the compass 21° 40' east; and high water 20' after the moon passed the meredian. From hence in a south direction this southern branch reached about 2 leagues further, where it took a sharp turn to the W. S. W. about 4 miles, and there communicated with a still more extensive opening, stretching to the S. W. and N. W. The land on the western side appeared to form a large island, on which rose a conspicuous ridge of mountains, with a remarkable peak nearly in their centre, considerably above the rest; their summits were naked rocks, without the least appearance of verdure; the land to the southward was much lower, seemed greatly broken, and probably afforded several passages to sea. * *

This was in a spacious channel about 2 miles in width, stretching in a westerly direction, which they followed about a league, when it opened to their view another still more extensive, taking a northwest and southeast course, and bounded by land near 2 leagues distant; this Mr. Johnstone concluded to be Banks' Island, so named by some of the traders. * * *

The country that had fallen under their observation differed little from the general character of the surrounding region. That on the sea coast was somewhat less mountainous, chiefly covered with wood, and less encumbered with snow than the barren, ruggid summits of the mountains of the interior country. * * *

By seven in the evening we had advanced from the anchorage we had quitted only five miles up the western arm; it was about a mile in width, and the steepness of its rocky sides afforded little prospect of obtaining any anchorage on which we could depend for the night. We had repeatedly traversed from shore to shore without finding bottom with 165 and 185 fathoms of line, though within half the ship's length of the rocks. The tide was now making against us, we were constrained to rest our sides against the rocks, and by hawsers fastened to the trees to prevent our being driven back. Our present resting place was perfectly safe, but this is not the case against every part of these rocky precipices, as they are frequently found to jet out a few yards at or a little beneath low-water mark; and if a vessel should ground on any of those projecting parts about high water, she would, on the falling tide if heeling from the shore, be in a very dangerous situation. * * * *

The next morning [June 24th] as they were preparing to proceed, a smoke was discovered issuing from amongst the stones, on the shore, that, at low tide, formed a kind of beach. On examination, a run of hot water was found passing amongst the stones, which at high tide must be at least six feet beneath the surface of the sea. They were not able to discover its source, and having no thermometer, its degree of heat could not be ascertained. Some of the seamen attempted to wash their hands in it, but found the heat inconvenient. * * * *

This point was named by Mr. Whidbey POINT STANIFORTH, and is situated in latitude 53° 34', longitude 231° 17'. The shores they had passed were in part composed of lofty steep mountains that rose nearly perpendicularly from the sea, and were covered from the water side to their summits with pines and forest trees. The other parts, equally well wooded, were less elevated, and terminated in sandy beaches with projecting points, forming several small bays and coves; and before they reached that part of the inlet which took an easterly direction, Mr. Whidbey observed more drift wood than he had seen on any other part of the coast. After breakfast the party entered the south-easterly branch, and found its shores composed of mountains that were barren towards their summits, but well wooded near the water side. As they advanced, its width increased to about half a league; and in a direction S. 60 E. 3½ miles from Point Staniforth, an island lies nearly in mid-channel, where they stopped to dine. At the entrance into this arm a tide was found in their favor, and not being more than half flood by the shore, Mr. Whidbey was flattered by the prospect of carrying the flood tide some distance; it, however, shortly turned, with a breeze, down the arm, and they were six hours advancing 4 miles. They quitted their dinner station, leaving unexamined a small arm extending from the southern shore, and pursued the main branch, taking a direction from the island S. 55 E. This was traced along the southern shore 10 miles, until they arrived at a place that had the appearance of being a small bay; here they stopped for the night after having advanced through a very desolate country, whose inhospitable shores were formed by such steep barren rocky precipices, as rendered the landing very difficult. A very few trees were thinly dispersed, of a slender dwarf kind, produced upon the naked rock. * * *

At daylight on the 26th the situation was discovered, instead of being in a small bay as had been supposed, to be a little way within the entrance of a small rivulet, about a cable's length wide, admitting, for about a fourth part of that extent, a passage of 5 fathoms water

It took a winding course to the south west, between two mountains; the tide of the flood ran strongly up, and the ebb with such impetuosity that the boats could not make the least way against the current.

As many sunken rocks were lying across its entrance, Mr. Whidbey did not think it an object worth hazarding any further examination; and for that reason he proceeded immediately up the arm, taking an irregular direction, first about N. 50 E. for eight miles, and then about S. 55 E. 22 miles; where, as usual it terminated in shoal water, before a border of low land through which flowed several small streams or rivulets of fresh water. The latitude appeared to be 53° 20', longitude 232° 17'; it was high water by the shore, 36' after the moon passed the meridian, and the rise and fall of the tide was about fourteen feet.

On the morning of the 27th they returned down this arm, which, after Sir Allen Gardner, I called GARDNER'S CANAL. On this occasion Mr Whidbey observed that the face of the country through which they had passed from the little rapid rivulet, was almost entirely barren waste nearly destitute of wood and verdure, and presenting to the eye one rude mass of almost naked rocks, rising into rugged mountains more lofty than he had before seen, whose towering summits seeming to overhang their bases gave them a tremendous appearance. The whole was covered with perpetua ice and snow, that reached, in the gullies formed between the mountains close down to the high water mark; and many waterfalls of various dimensions were seen to descend in every direction.

By the morning of the 28th, they had reached the small arm on the southern shore, that had been passed unexamined on the afternoon of the

25th. This they now found extending S. 35 E. nine miles from Point Staniforth, where it terminated as usual From thence the party proceeded about seven miles up what appeared to be the main branch of the inlet, where they rested for the night, on the eastern shore, opposite to an island lying nearly in mid-channel. This station lies from Point Staniforth N. 10° W. eight miles The shores of the continent, from the southeastern arm, were nearly straight and compact. * *

The weather was calm, with heavy rain in the morning of the 29th, and so it continued all the day; notwithstanding this Mr. Whidbey resumed his examination in the afternoon, along the eastern or continental shore. From their place of rest it took a north direction for nine miles, to a projecting point that obtained the name of POINT HOPKINS, forming, within those limits, a deep bend, in which were many sandy bays. The shores here were moderately elevated and well covered with wood. Two openings to the south of this point were passed on the opposite shore. From hence the main inlet appeared to divide into two branches, one taking a northeasterly, the other a northwesterly direction The former, as being a continuation of the continent, was first attended to, and was found to extend N. 37 E. seven miles to the south point of a small branch about half a mile wide. The eastern shore here formed a large sandy bay, and to the westward some rocky islets, and an island about four miles long were passed. * * * *

On making signs to the Indians that they were going to rest, all these immediately retired to another cove, at a little distance, where they remained perfectly quiet; and at four the next morning (the 30th) they accompanied them again in their researches up the main branch of the inlet. From hence it was about two miles wide, and took nearly a north direction 9 miles, to the latitude 54° 4', longtitude 231° 19', where it was terminated by a border of low land; whence extended a shallow flat from side to side, through which a small rivulet discharged itself at its eastern corner, navigable for canoes only. This termination differed in some respect from many of the others; its shores were not very abrupt, but were bounded on each side by a range of lofty mountains which, however, were not (as had been constantly the case) connected at the head of the arm, but continued seemingly in a direction parallel to each other. The valley between them, which was three or four miles wide, formed nearly a plain. and was covered with tall forest trees, mostly of the pine tribe. This plain was supposed by Mr. Whidbey to extend some leagues, to where the distant mountains appeared to connect the two ranges. Our party made a late breakfast near the entrance of the rivulet, where they found the remains of an Indian village. On their moving from thence, their Indian attendants took their leave, went up the rivulet in their canoes, and were seen no more. Contrary winds, though the weather was now pleasant, retarded their progress so much, that by nine at night they had not reached more than eleven miles in a direction S. 20 W. from the head of the inlet. Here they stopped for the night on the western shore, close to a very large waterfall, about ten feet above high water mark, that had its source in a lake of fresh water which appeared to be deep, lying in a northwest direction. About three in the morn-

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APPENDIX O.

NAVIGATION OF THE LAKES AND RIVERS IN THE PRAIRIE REGION.

(1) *Report on the subject of the navigation of the North and Main Saskatchewan, by* ALFRED R. C. SELWYN, ESQ., *Director of the Geological Survey.*

MONTREAL, 9th January, 1874.

MY DEAR SIR,—

I have just received your note of yesterday, asking about the navigation of the Saskatchewan. First, I may say I did not see the Mossy Portage or any portion of either Lake Winnepegosis or Lake Manitoba, and, therefore, cannot say much about that route. I am, however, of opinion that except for the purpose of facilitating the settlement of the rich lands which lie west of the above named lakes and the upper sources of Assiniboine River, which is doubtless a consideration in favor of the Manitoba Lake route, the route *via* Lake Winnipeg and the Grand Rapid would be the best on which to establish steam communication, unless the Mossy Portage and Beaver Portage could be *canalled*. The Manitoba Lake route would involve too many transhipments to make it a permanently desirable one, either as regards time or expense. Beaver Portage might, perhaps, be avoided by using Water Hen River, supposing that river to be navigable for steamers, which is, I believe, doubtful. My journey down the Saskatchewan was performed between the 12th of September and the 17th of October, and therefore in some respects at a very unfavorable season to judge of the practicability of navigating it with steamboats. Throughout the whole length of the river, the channel is more or less subdivided by islands, and every sub-channel is again cut up and obstructed by shoals and sandbanks. Of course I saw these almost at their worst, as the water was everywhere from two to four feet lower than it would be at the opening of navigation, in May or early in June. Nothing whatever can, I believe, be done that would obviate or lessen the constant formation and shifting of these shoals and sandbars, and the consequent annual changes in the position and depth of the main channel, a circumstance which must always render the navigation of the Saskatchewan above Fort à la Corne difficult, and more or less subject to delays, and especially so towards the latter end of the season. For four months, however, under ordinary circumstances no serious obstacle would be encountered in the navigation of the river by properly constructed steamboats, from above the Grand Rapid even to Rocky Mountain House. Moderate length, powerful engines, light draft, and as much strength as possible below the water-line are essential points in the construction of any steamers which may be built for navigating the Saskatchewan.

The utter failure and loss of the Hudson's Bay Company's steamboat last year, with the details of which you are perhaps acquainted, may be ascribed almost entirely to want of attention to these requirements. She was far too long and too weak both in hull and machinery, and when I saw her lying a wreck on the bank of the river, at the head of the Grand Rapid, I felt convinced that the man who built her could never have traversed the route for which she was designed, and I subsequently learnt that this was actually the case.

Towing flat boats or barges, as practised on Red River, would, I think, be quite impracticable on the Saskatchewan, for the reason that in many places the current is too strong, and in others the available channels between the islands and sandbars or shoals are too narrow and tortuous.

The only really insurmountable obstruction to steam navigation from Fort Garry to Rocky Mountain House is the Grand Rapid. It appears to have been carefully measured by Prof. Hind, who states it to be 2¾ miles in length, with a total fall of 43½ feet. Whether the outlay requisite for a canal and locks to surmount this would be repaid by the result is a matter for consideration. Between the head of the Grand Rapid and the confluence of the two Saskatchewans, there are only two places, especially during the latter part of the season, when the water is low, where steamboats might experience some difficulty, and would possibly require to be warped against the current—these are the Cross Lake Rapid, and Tobin's, or Thobon's Rapid: the one between Cedar Lake and Grand Rapid, and the other between Cumberland, or Pine Island Lake and Fort à la Corne. Immediately above the confluence of the north and south branches are the *Coal* or *Coles* Falls. Next to the Grand Rapid, these falls appear to me to constitute the most serious impediment to the navigation. They extend over a length, according to my estimate, of rather more than twelve miles. I am not able to say exactly what the total fall is, but my two barometers gave a difference of 0.44 and 0.45 respectively, between the junction and the upper end of the falls; this would indicate a fall in that distance of from 40 to 45 feet. Enclosed is a tracing from my note book of the sketch survey I made of this part of the river. The width is from 150 to 170 or 200 yards, and the rapids vary in length from 100 yards to about a quarter of a mile. The bed of the river is everywhere filled with large rounded boulders of gneiss, granite and limestone; and when we passed, many of these were showing above the water, while more were covered only a few inches deep. This was on the 4th of October, and then no steamboat coul have passed either up or down with safety. Our boat, an ordinar Hudson's Bay batteau, 42 feet long, 30 feet keel, and drawing only abou 18 inches, touched the rocks several times, notwithstanding that we had careful and experienced steersman, well acquainted with the deepe channel; with two or three feet more water in the river, of course th appearance of these rapids would be greatly altered, and, as there is no soli rock, the danger and difficulty of their navigation might be greatly lessene if not altogether obviated by the removal of some of the large boulde which might probably be effected at a comparatively small cost. Th current on this piece of the river, must, however, always be very heavy, an proper arrangements for warping boats up these rapids in case of necessit should be made in advance. There is another very important matter connected with the Saskatchewan navigation, which would require careful consideration. I allude to the great scarcity and poor quality for steam purposes of the wood, which could be procured on long stretches of the river above Carlton; indeed, in the whole distance between Carlton and Edmonton this difficulty would arise, and I question whether it would not be more economical to establish coaling stations, which could be supplied from the thick seams above Edmonton, than to use either poplar or spruce wood, neither of them of much value for steam purposes, especially where constant full pressure would be necessary.

The coal in the seams referred to is very favorably situated for working and shipment, and could be taken down stream at a comparatively small cost. The arrangements for the return of the empty barges up stream would be the principal item of expense. My impression at present is that the coal bearing rocks which crop up in the banks of the river from near Victoria upwards, pass, with their associated coal seams and iron ores, beneath the cretaceous septaria clays, which are observed in the vicinity of Fort Pitt, and it may be, that boring along the river valley would reveal workable seams of coal, at such a limited depth beneath the surface as would render them available even as low down as Carlton.

I am, dear sir,
Yours truly,
(Signed,) ALFRED R. C. SELWYN.

SANDFORD FLEMING, Esq., C. E., &c., &c., &c.,
Ottawa.

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(2) *Memorandum on the Portages and Streams between the Lakes Winnipeg, Manitoba, Winnepegoosis, and the River Saskatchewan at Cedar Lake. From report on Surveys made by* HENRY B. SMITH, *C. E., in* 1873.

THE SASKATCHEWAN RIVER BETWEEN CEDAR LAKE AND WINNIPEG.

This river flows in an easterly direction from Cedar Lake for a distance of about 12 miles, falling into Lake Winnipeg near its northwesterly angle. The total fall in this distance is estimated to be 60 feet, divided into five rapids, ranging from 1 to 7 feet in height, and the Grand Rapids which fall 43½ feet in a distance of 2½ miles. The current between the rapids, except through Cross Lake, is about 3 to 3½ miles per hour. The Hudson's Bay Co. have three portages on this route; total length of these—1¼ miles.

MOSSY PORTAGE.

Between Cedar Lake and Winnipegoosis.

The level of these lakes may be assumed to be equal, that is to say, about 60 feet above Lake Winnipeg. Starting from a fine open bay on Cedar Lake, free of Islands, and about 2,000 feet in breadth, with a bottom composed of mud and sand, sloping off gradually to a depth of six feet at a distance of 660 feet from the shore, the portage passes over a corduroy road for three-quarters of a mile, through a very soft muskeg or swamp, to a fine hard ridge of land along which the H. B Co. have built their wag road.

The total length in a straight line between the lakes is nearly f miles. Travelling in a southerly direction from Cedar Lake the land r gradually to a height of 93.14 feet at a point only one quarter of a mile fr the shore of Winnepegoosis, then descends suddenly to its beach. Wi pegoosis here presents a wide surface, affording no natural protection boats from the heavy storms which are so frequent in these parts. bottom of the lake, composed of limestone gravel, slopes away gradu to a depth of six feet at 200 feet from the shore.

Some good timber can be obtained on this section from 10" to 18" diameter.

WATER HEN RIVER.

Between Lakes Winnepegoosis and Manitoba.

The total distance by this river between the above lakes is 30 mi and the difference of level 18.73 feet.

After traversing a long reach of Lake Winnepegoosis, the Water H River is entered, flowing in a northeasterly direction between low mar banks, with a current of 3 miles an hour over a muddy bottom; its aver width is about 500 to 600 feet and depth 5 to 6 feet; the difference of le on this section known as the "North Branch" is about 6 feet.

Water Hen Lake is now reached, a very shallow sheet of water, fil with boulders lying on a stiff clay bottom, and so close together that channel can be found; the average depth in July, 1872, was only 3 f but Hudson's Bay Co's. servants state that in 1871 the depth did not exc 2 feet, and that they have known it to be as low as 1'-6".

Leaving Water Hen Lake the river flows at an average rate of fr 3 to 4 miles an hour in a southerly direction to the "Forks." The de varies from 3½ to 17 feet, and the channel is in many places obstructed large boulders, so as to interfere seriously with navigation.

Along the banks of the river a few tamarac, about 12" in diam. can obtained, the rest of the timber is worthless.

The average width of this portion of the river is about 500 feet, bottom is stony as far down as the Forks, where it becomes muddy.

MEADOW PORTAGE.

Between Lakes Winnepegoosis and Manitoba.

The total distance between these lakes is nearly 1¾ miles, and the ference of level 18.73 feet.

This portage traverses a low marshy neck of land separating La Winnepegoosis from Manitoba, and may be considered a rival route to Water Hen River.

Its general course is easterly, and the greatest elevation attained abo Winnepegoosis is 10 feet. A test pit sunk at this point gave 12" black loa 3" small limestones, 12" marl and then more limestones.

The timber in this section is very poor—a few scrubby oak 12" dia can be obtained. No stone appears, except along the shore of Manito

Lake, where a wall of broken limestones, compressed together, is exposed by the action of the waves.

There is no natural harbour, nor any protection for boats at either end of this portage, the water is very shallow, being only 6 feet deep at 2,000 feet distance from the shore in Winnepegoosis, and in Manitoba the same depth at 660 feet from the shore.

PARTRIDGE CROP AND DAUPHINE RIVER.

Between Lakes Manitoba and Winnipeg.

The waters of Lakes Manitoba and Winnepegoosis flow northeasterly to Lake Winnipeg through Partridge Crop River into St. Martin's Lake, thence through the Little Saskatchewan to Winnipeg, a total distance of about 68 miles, with about 41 feet fall.

"Partridge Crop River" is nine miles in length, flowing through a channel 500 feet wide, constantly broken by rapids and obstructed by boulders, the depth being only 2' 6" on the crest of the rapids.

As these soundings were taken when the water was high, according to the best information obtainable, about ten inches may be deducted for low water. Near the bend of the river (see plan) it widens out to 1,300 feet, and here the depth is only 3 feet for a distance of 1,300 feet, with a gravelly bed covered by boulders.

Through St. Martin's Lake a channel was found with 8 feet of water, bottom muddy with weeds. At the narrows it shoals to 4 feet and afterwards passes over a mud bar with only 2' 6" water; Shoal Bay is entered near the mouth of the Little Saskatchewan; there is no regular channel; the bottom of fine clay covered with boulders making navigation very dangerous. Total length of this lake on navigable route 21 miles.

The average breadth of Dauphine river is 260 feet, with a depth of from 3 to 4 feet, it flows in a northerly direction at a rate of from 1 to 7 miles an hour; the banks are low and marshy on the northern branch, while on the eastern branch they are from 6 to 20 feet high. There are thirty rapids on this stream, and the bottom, composed of coarse gravel, is covered with very large boulders. In some of the rapids the greatest depth is not more than two feet and the current from 7 to 8 miles an hour. Timber is poor in this section. Juniper and Tamarac, from 8" to 15" through may be found.

The total fall between Lakes Manitoba and Winnipeg is about 42 feet.

Before entering Partridge Crop river, Lake Manitoba is very shallow—for a distance of a mile not more than 3 feet can be obtained.

At the mouth of the Dauphine River a fine sheltered bay of Lake Winnipeg is entered, with deep water.

PRAIRIE PORTAGE.

Between Lake Manitoba and the Assiniboine River, near Portage la Prairie.

The southerly end of Lake Manitoba is bounded by a narrow bank of sand varying from 100 to 200 feet in width, and 4 to 10 feet in height.

This bank encloses a deep marsh, producing reeds and rushes from 6 to 8 feet in height. Numerous water holes are also found, with an average depth of 7 feet, until the mouth of Portage Creek is reached.

This creek is from 300 to 500 feet in width, with from 1 to 2 feet of soft mud, and a clear depth of 3' 6" to 5 feet of water.

No timber of any value is to be found in this section of the country, and only a few dwarf oaks are to be seen.

From the head waters of Portage Creek to the Assiniboine River the distance is 7 miles across a gently rolling prairie, but to reach water communication in Portage Creek of 3' 6" in depth the distance would be 10 miles.

The waters of the Assiniboine were on the 8th October, 1872, 14.82 feet above the level of Manitoba Lake.

Test pits sunk on the Portage gave 2 feet loam, 3 feet stiff clay and then sand.

TABLE OF LEVELS.

NAMES OF LAKES.	Elevation above the Sea
	Feet.
Winnipeg Lake	710
St. Martins "	737
Manitoba "	752
Water Hen "	764
Winnepegoosis Lake	770
Cedar "	770

For Plans and sections of the various Portages above referred to, see sheet No. 11

APPENDIX P.

Meteorological Observations in the Rocky Mountains,—deductions by PROF. KINGSTON, *of the Magnetic Observatory, Toronto; and Report on the Winter Climate of the Yellow Head Pass and approaches thereto, by* MR. WALTER MOBERLY.

MAGNETIC OBSERVATORY,
TORONTO, Canada, March 28th, 1874.

SANDFORD FLEMING, Esq.,
Ottawa.

DEAR SIR,

I assure you that no time has been lost in making such use of your Meteorological Register as it was possible for me to make under the circumstances.

The columns of your register were transcribed so as to form 15 separate abstract sheets, from which the various columns in Table I. were derived.

Tables II. and III. give a condensed comparison of the Rocky Mountain Stations, with several places in the settled regions, and I think that the West will not lose by the comparison.

Table IV. is an attempt to make some use of the recorded direction of winds; but little is possible with so few examples.

The written reports of Mr. Moberly are very interesting. I send them back at once, lest you should require them; but I have taken the liberty of having a copy made in case of desiring to refer to them again.

Hoping that what I send will be of service to you,

I remain,
Truly yours,
G. T. KINGSTON.

Tables derived from the Meteorological Register kept at certain stations in the Rocky Mountains, from November, 1871, *to October,* 1873, *under the immediate direction of* MR. RYLATT, *of the Pacific Railway Survey.*

TABLE I.—Contains a summary of the observations.

The averages and other numbers are given for monthly periods when the months are complete; but where this has not been practicable, in consequence of change of station, periods less than a month have been taken, and sometimes periods composed of parts of two consecutive months.

The numbers given as the mean temperatures are the arithmetical means of the means at 9 a.m. and 9 p.m., excluding those for noon or 3 p.m. Means thus found, though not absolutely correct, do n differ greatly from the truth.

The middle of the three daily readings of the thermometer wer taken at noon from Nov. 9th, 1871, to Jan. 17th, 1872; after which the were taken at 3 p.m. This explains the double entry in January, 187

In one instance only was the temperature recorded as low as—34 namely at Howe Pass in Dec., 1871; but as the thermometer was n graduated below that point, it is possible that on that occasion th actual temperature was lower than—34°.

TABLE I.

Summary of Meteorological Observations taken in certain districts of the Rocky Mountains, from November 1871 to October 1873.

(1) HOWE'S PASS, COLUMBIA RIVER, LATITUDE 51° 23' N. LONGITUD

DATES.	TEMPERATURE.							Number of days of Rain.	Number of days of Snow.	Amou of Snow
	Mean 9 a.m.	Mean Noon 3 p.m.	Mean 9 p.m.	Mean 9 a.m. 9 p.m.	Mean Minim	Absolute Minim.	Highest observed Temp.			
1871										Inch
Nov. 9th to 30th.....	15.5	21.7	18 4	18.9	12 6	—12.0	33.0	1	9	......
Dec. 1st to 31st......	0.6	9.7	—0.2	0.2	—7.6	—34.0	30.0	0	8	25.
1872										
Jan. 1st. to 31st.....	10.6	21.7 16.7	12.6	11.6	6.8	—17.5	34.0	0	7	16.
Feby, 1st. to 28th....	17.2	26.9	18.2	17.7	12 3	—20.0	46.0	5	8	29.
March 1st to 31st....	30.6	45.6	30.9	30.8	21.0	6.0	58.0	4	4	6.
April 1st to 30th.....	38.4	53.3	34.9	36.7	28.0	21.0	70.0	4	2	......
May 1st to 31st......	54.2	65.2	48.0	51.1	36.6	30.0	84.0	4	0	......
June 1st to 26th.....	60.2	72.5	52.5	56.3	40.5	31.5	86.5	5	0	......
(2) Mouth of Canyon, Columbia River.										
July 3rd to 25th....	70.7	77.7	58.4	64.5	46.2	35.0	91.0	1	0	
(3) Placid River.										
July 31st to Aug. 21st	64.4	78.4	57.2	60.8	48.4	41.0	89.0	5	0	
(4) Foot of Kinbaskit Lake.										
Sept. 1st to 25th....	53.5	58.5	49.7	51.6	43.2	28.5	74.0	7	0	
(5) Boat Encampment.										
September 30th	46.0	51.0	45.0	45 5	"	41.0	51.0	1	0	
(6) Foot of Mount Hooker, Athabasca Pass.										
October 3rd to 7th..	47.5	50.0	42.5	45.0	40.8	30.0	55.0	4	0	

TABLE I.—(CONTINUED.)

Summary of Meteorological Observations taken in certain districts of the Rocky Mountains, from November, 1871, to October, 1873.

DATES.	TEMPERATURE.							Number of days of Rain.	Number of days of Snow.	Amount of Snow.
	Mean 9 a.m.	Mean 3 p.m.	Mean 9 p.m.	Mean 9 a.m. 9 p.m.	Mean Minim	Absolute Minim.	Highest observed Temp.			
(7) *Summit Athabasca Pass.*										Inches.
October 13th to 17th.	43.6	50.6	39.6	11.6	33.2	28.0	50.0	1	0	
(8) *Whirlpool River, Athabasca Pass.*										
October 23rd to 28th.	32.2	38.3	28.3	30.3	23.7	12.0	42.0	0	1	
(9) *Athabaska Depot. Lat.* 52 ° 56' *N. Long.*										
Nov. 1st to 30th....	18.0	21.9	12.8	12.9	5.6	−20.0	40.0	1	5	7.5
Dec. 1st to 31st.....	7.8	15.8	7.7	7.5	−0.5	−31.0	40.5	0	1	4.0
(9) ATHABASCA DEPOT, LATITUDE 52 ° 56' N. LONGITUDE.										
1873										
January 1st to 31st..	10°.0	17°.4	8°.4	9°.2	0°.5	−26°.5	42°.7	1	9	4.0
February 1st to 28th..	18.7	27.5	15.6	14.7	4.4	−24.5	39.3	0	5	2.0
March 1st to 31st...	29.5	38.8	26.8	28.2	17.3	−11.0	59.3	2	4	6.5
April 1st to 11th...	38.2	49.3	33.9	36.1	25.3	16.5	59.5	0	0	
(10) *Fiddle River Depot.*										
April 14th to 30th...	48.3	51.9	39.5	41.4	29.9	15.0	63.5	2	3	0.5
May 1st to 6th......	50.7	56.3	41.2	45.9	37.7	31.0	64.0	3	1	
(11) *Pleasant Camp.*										
May 10th to 31st....	49.3	58.2	37.5	43.4	31.5	27.0	71.0	9	2	30.0
June 1st to 6th.....	50.8	54.7	40.1	45.2	36.2	32.0	65.0	3	1	
(12) *McLeod River Depot.*										
June 8th to 30th....	63.9	64.2	49.4	56.6	48.9	24.0	76.0	8	0	
July 1st to 7th,....	60.2	60.5	49.2	51.7	38.7	30.0	70.0	5	0	
(13) *Fraser River,* 3 *miles below Moose Lake.*										
Sept. 5th to 17th...	52.4	57.9	43.5	47.9	34.6	22.0	69.0	3	6	
(14) *Grand Forks of Fraser River.*										
Sept. 18th to 29th..	48.4	46.9	37.8	40.6	29.8	18.0	55.0	4	3	
(15) *Cranberry Valley.*										
October 5th to 8th.	44.7	55.7	44.8	44.5	30.7	28.0	67.0			

TABLE IV.

Table shewing the frequency with which the wind blew from the eight principal points, at various stations. The total number of winds recorded at each station being expressed by 100.

Dates, 1873.	N.	N-E.	E.	S-E.	S.	S-W.	W.	N-W.
Athabasca Depot, Lat. 52° 56′ N.								
March 1st to April 11th……………………	16.7	0	0	0	80.1	1.6	1.6	0
Fiddle River Depot.								
April 14th to May 6th……………………	40.6	14.5	1.4	0	36.2	5.8	0	1.5
Pleasant Camp.								
May 11th to June 6th……………………	27.1	24.3	2.9	12.9	11.4	15.7	1.4	4.3
McLeod River Depot.								
June 8th to July 7th……………………	5.9	23.5	4.4	22.1	10.3	26.4	0	7.4
Fraser River, 3 miles below Moose Lake.								
September 5th to 17th……………………	6.1	33.3	0	9.1	15.2	21.2	12.1	3.0
Grand Forks of Fraser River.								
September 19th to 29th……………………	13.3	53.3	0	0	0	26.7	0	6.7
Cranberry Valley.								
October 5th to 8th……………………	33.3	55.6	0	11.1	0	0	0	0

Report on the Winter Climate of the Rocky Mountains, more particularly that of the Yellow Head Pass and the approaches thereto, by

WALTER MOBERLY, ESQ.

SANDFORD FLEMING, ESQ.,
Engineer-in-Chief,

DEAR SIR,—

In submitting a register of meteorological observations taken during part of the year 1871, '72 and '73, at various points in the Rocky Mountains, I desire to accompany them with the following remarks on the climate of a portion of that region :—

With regard to the nature of the winter climate in the Yellow Head Pass, and some of its approaches, I will briefly state the most important information obtained.

The Indians that live in the neighborhood of Tête Jaune Cache informed me the greatest depth of snow during the winter in the wide valley at

Cranberry Lake is about four feet. From what I could gather from them the snow generally begins to fall there about the first week in November.

They also told me the snow in the valley of the North Thompson, below the forks of Albreda and above Stillwater, begins to fall a few days before it does at Cranberry Lake, and continues on the ground later in the spring; judging from what I could make out from them the greatest depth in the valley of the North Thompson rarely exceeds five feet.

When I tried to get through the mountains south of the valley of the North Thompson, about twenty miles above its junction with the Albreda River in the direction of the Clearwater Lakes, I encountered a snowstorm on the 21st October, but at that time was some eight hundred feet above the level of the Thompson River, where I left it. I think I took the wrong opening in the mountains, as I subsequently learnt from an Indian that I should have taken the next one above it in order to get to the north end of Clearwater Lake. From thence, on my journey to Kamloops, the weather was remarkably fine and no snow fell.

In the valley of the Fraser, from Tête Jaune Cache to the summit of the Yellow Head Pass, light drizzling rains fell in the autumns of 1872-3, and we had frost about the beginning of October.

At the summit of Yellow Head Pass, and at the lake of the same name, there was two feet of snow in the first week of March, 1873.

Easterly from the above summit, through the Caledonian Valley, we had very fine weather from the 24th October until the 7th of November; on the latter date about two inches of snow fell during the night at our camp on the Miette, nine miles from the Athabasca.

The total fall of snow in the winter of 1872-3 at our depot on Jasper Valley, twenty-two miles east of the summit of the Yellow Head Pass, was two feet one and a half inches, and the greatest depth on the ground at one time was six and a half inches.

Jasper Valley, from the Miette, and as far down the River Athabasca as I have been, viz.: about forty miles below Jasper House, has a dry climate. With the exception of a few occasional drops, I never saw any rain.

There were some spells of frost in November and a continuance of very cold weather, from the 13th to the 28th of December; it was cold in January and for four or five days in February; at other times during the winter the weather was comparatively warm, frequently not even at the freezing point. The winds that blow with much violence render Jasper valley unpleasant in the winter; the northeast wind always brought cold and the southwest warm weather.

From the beginning of March until about the 20th of May, with the exception of a little snow on the 26th and 27th of April, the weather was remarkably fine. This is the best season for field work, as the flies do not make their appearance until the beginning of June.

Comparatively speaking, the winter months in the district referred to are not as severe as at Toronto. To give an instance I will mention that the pack arrivals (horses and mules) with the expedition after an unusually hard season's work of about nine months duration, when they were very much worn out and nearly starved after packing the supplies over th Rocky Mountains by the Athabasca Pass, the altitude of which is 6025 fee above the sea, and at a time when severe weather and snow storms wer almost incessant, the animals were turned out about the 20th of Januar to shift for themselves as we had no fodder for them. Not a single one o them died, and they were all in fair condition when they resumed worl the following March.

The frost does not appear to penetrate the earth to any depth in th mountains as the snow covers the ground before the severe weather set in. Apparently the water in the rivers is not as cold in the winter as it i after the snow begins to melt and the rivers rise. In the winter the stream are fed from springs, but when the cold weather breaks up the icy col water from the melting snow is the principal source from which they are fed

On leaving our depot in Jasper Valley on the 14th of March, I foun on the banks of the Athabasca only two or three inches of snow in places On the top of the high ridge between the Athabasca and McLeod Rivers west of the height crossed by the Hudson's Bay Trail, there was fron three to four feet of snow in the early part of April; on the 16th of Apri when I crossed this ridge by the Hudson's Bay Trail, there were a few patches of snow at the summit from nine to ten inches in depth, but o arriving the same day at the McLeod there was not any snow.

On the 26th of May, on the top of the above ridge, we experienced heavy fall of snow two feet eight inches in depth, with much wind; a the same time there was only a fall of some two or three inches along th river Athabasca, and about eighteen inches along the McLeod.

From the beginning of June until the end of July, we had almos daily but light showers of rain, the climate becoming much damper whe we left the river Athabasca, and crossed the ridge into the McLeod Valley

Night frosts were frequent during the time we were to the eastwar of the mountains; this circumstance will not be favorable for agricultura pursuits in that section of the country, although the soil in places is rich grasses and vetches grow very luxuriantly wherever openings in the fores occur.

From one winter's personal experience, and all the information I hav been able to acquire from others, I do not think obstructions from sno need be feared from Edmonton to Kamloops should a railway be constructed between those points, via the Yellow Head Pass.

I may observe that Mr. Logan, the gentleman in charge of Jasper House, told me the winter of 1872-3 was one of unusual severity at For Edmonton.

The foregoing remarks are chiefly in reference to the winter climate o the line of survey; I shall now add a few observations on the climate o the mountain region generally.

The prevailing winds in the valley of Athabasca River, which ar generally northeasterly and southwesterly, (varying slightly in their cours being guided to a certain extent by and following the direction of the valleys through which they blow,) caused me to notice that when there wa a prevalence for several days of wind from the north and east, the weather was much more severe than when it blew from the south and west. (*down* *from the mountains.*) Last year I was surprised at the warmth of the strong winds that blew *down* the valley of the North Saskatchewan River from the south and west during the time (latter portion of October) occupied in making the trip from the summit of Howe's Pass to the Kootanie Plain, on the North Saskatchewan.

The extremely cold weather we had during portions of the months of November and December in the Howe's and Yellow Head Passes, was succeeded in both instances by remarkably mild weather, similar to that of early spring in the Province of Ontario, and during which, when occupied in writing and drawing, we kept the doors of our huts open as they were unpleasantly warm.

The very small quantity of snow we met with at our depot in the Jasper Valley, (22 miles from the summit of the Rocky Mountains) and the small quantity found by Mr. A. H. Green about the end of February, 1872, near the summit of Howe's Pass on the open flat south of Mount Forbes, where it *was all newly fallen snow* from six to twelve inches in depth, (difference caused by drifting) and decreased rapidly as he descended the North Saskatchewan a short distance; the ground being bare in places has, in conjunction with the observations made as stated in the last two paragraphs, led me to infer the climate of the two Passes is very similar.

Another circumstance also appeared at first rather singular: from various reports and tables I have examined, those of Colonel J. H. Lefroy, R. A., Capt. Palliser and Dr. Hector, respecting the climate of the country. East of the Rocky Mountains, (Fort Edmonton for instance,) the snow appears to attain a greater depth, and the weather a greater degree of severity than where we spent part of the winter east of the Yellow Head Pass. From what I have learnt of the valley of the North Saskatchewan near its source, I think it not improbable the same would prove to be the case there; and it is my impression, although it may appear rather unreasonable, that the mean winter temperature through a series of winters will show a much milder climate to exist at the two above mentioned points than at Fort Edmonton.

December appears in all these places to have the longest continuance of cold weather.

The above peculiarities apparently being the case, it naturally follows that there must be causes by which they are brought about, and as far as I can as yet form an opinion I have attributed them *principally* to the following:

1. The valleys of the upper waters of the North Saskatchewan and Athabasca Rivers present a remarkable similarity in many respects: both being wide with extensive flats and branches, lightly timbered and penetrating with easy and gradual ascents to the height of land in the Rocky Mountains, the valley of the Athabasca being a little wider in places, but that of the North Sasktchewan "carrying its width" to the height of land which the other does not quite so fully.

2. Immediately along the westerly base of the Rocky Mountains there is a large, extensive, and continuous valley of comparatively low altitude to that of the adjacent mountains, extending from and connected with the

plateau country (*The "Great Columbian Desert"*) east of Walla Wall (from which locality—dry, arid, and warm—it is connected by the vall of the lower Columbia, with the Pacific Coast,) and which valley is form or rather prolonged from the northeasterly corner of that Plateau latitude 47° N., longitude 116° W., by those known as the Kootanie (far as latitude 50° 8' N.,) the McGillivray branch of the Columbia and t Canoe and Cranberry Rivers to Tête Jaune Cache in about latitude 5 N., and also connected with Walla Walla by the portion of the Columb Valley between that point and the Boat Encampment at the confluence the Canoe and Columbia Rivers in latitude 52° 7' N; this great valley h various branches extending far into the mountains on either side, amon which are those of Blackberry River, (Howe's Pass,) Portage River, (Ath basca Pass,) and the valley of the Fraser, west of Tête Jaune Cache, (Y low Head Pass.)

3. It is a well established fact that the climate on the eastern side the Rocky Mountains is much more severe than that on the western si in the same latitude.

The Howe's, Athabasca, and Yellow Head Passes, branches of t great valley of the western slope, connecting with those of the Nor Saskatchewan and Athabasca Valleys on the eastern slope, afford as were "deep channels" through the mountains for the influx of the wa air of the Pacific Slope and ocean, the influence of which is so much f here, but on mixing with the colder atmosphere east of the Roc Mountains, its ameliorating effect rapidly decreases, and at no great d tance east of their base is unfelt.

I am, &c., &c.,

WALTER MOBERLY.

APPENDIX Q.

Reports, Recommendations, Orders in Council, and other documents in reference to the loss of Officers and Men engaged on the Survey up to January 1st 1874.

LOSS OF LIFE IN 1871 AND 1872.

OFFICE OF THE ENGINEER-IN-CHIEF,
OTTAWA, January 28, 1873.

The Hon. H. L. LANGEVIN, C.B.
Minister of Public Works.

SIR.—I beg to submit for the consideration of yourself and the Government some particulars in reference to three serious accidents, involving loss of life, that have taken place during the prosecution of the survey.

1ST ACCIDENT.—The first of these occurred on the 7th August, 1871, on the north shore of Lake Superior, between the mouth of Nepigon river and Long lake. The cause was fire in the woods, by which seven men, connected with the survey, lost their lives. Of these, two were white, and the others Half-breeds or Indians.

2ND ACCIDENT.—The second accident occurred on the 20th May, 1872, on Lake Temiscamingue, Upper Ottawa river; the cause was the upsetting of a canoe, by which four white men were drowned.

3RD ACCIDENT.—The third accident occurred on the 26th Nov., 1872, on the Georgian Bay, near Collingwood; the cause was the wreck of the steamer "Mary Ward." By this accident eight lives were lost, three of them belonging to the survey.

1st Accident Particulars.—The details of the first accident are given at page 63 of my "Progress Report" last year, it is therefore unnecessary to repeat them here, I shall therefore confine myself to stating what has been done in aid of the sufferers.

The two white men were named respectively Wm Matheson and Alex. Sinclair; the former was hired at Nepigon and had at one time been in the employment of the H. B. Company. No information could be obtained in reference to his home, connections, or friends.

The latter, Alex. Sinclair, was hired at Toronto, where his family reside. Through the representations of the Rev. Mr. McDonnell and others, that he was the only support of his father, the sum of $400.00 was granted by the Government to the latter.

With reference to the Half-breeds or Indians, enquiries were made of of the H. B Co.'s officers at Michipicoten and Pic, which places were the headquarters of the men who were lost, and their families, as to what would be best to do for the latter; acting on their suggestions, arrang ments were made to supply each family with food, during the fall an winter of 1871, and the spring of 1872, until such time as they could, b hunting and fishing, support themselves. This action satisfied all th interested parties.

2nd Accident Particulars.—The details of the second accident are follows :—

A party, consisting of Mr. A. Hamilton, Engineer in charge; E. J. Abbott, Transit-man; E. Haycock, Leveller; G. Knout, Hind Chainma with a number of Axe and Packmen,—of whom G. Rochette was one-had completed the survey of a portion of the line through the valley of t Montreal River; and on their way back to Ottawa, encamped at its mout Here the men were left in charge of Mr. Haycock, while Messrs. Hamilt and Abbott went up Lake Temiscamingue to the H. B. Co'y. Post, in a sma canoe, for the purpose of settling accounts, obtaining letters, and bringi down Messrs. Knout and Rochette, who were laid up with scurvy at t Rev. Mr. Pian's.

On the 20th May, having arranged their business at the H. B. Co post, they—Messrs. Hamilton and Abbott—started from tho Rev. Mr. Pia with Mr. Knout and Rochette in the small canoe, declining the use of larger one kindly offered by the above named gentleman. This was t last ever seen or heard of them On the 22nd May a man named McVei arrived at the camp from the Post, and, surprised at not seeing Mr. Ham ton and party there, informed Mr. Haycock that they had left the post t days before. This information causing great anxiety to be felt on th account, a search for them was immediately commenced, and, the follo ing day, their canoe was found, bottom up, with some books, papers, & tied in it, about five miles below the camp, or 17 miles from the Post. trace of the missing men could be found, nor, although by my orders t search was continued until the end of June, were any of the bodies covered.

The lake was rough the morning they left the Rev. Mr. Pian's; Mess Hamilton and Abbott were, however, good canoe men, it is therefore su posed that the sick men's limbs becoming cramped from sitting in the b tom of the canoe, they endeavored to change their position, thus overtu ni the canoe, and, the water being extremely cold, they were unable swim any distance and consequently were drowned.

3rd Accident Particulars.—The details of the third accident are follows :—A party, in charge of Wm. Murdoch, Esq., C. E., was sent make an exploration from Thunder Bay to the main line of Survey. Th eft Collingwood the 15th Nov. last, on board the Steamer Cumberla finding, after proceeding as far as Tober Moray Bay, that the steam would not take them through to Thunder Bay, in consequence of the cr refusing to go on, they took passage back for Collingwood on the steam Mary Ward.

On the 26th November, during thick weather and heavy wind Mary Ward was wrecked on a shoal a few miles to the west of Colli wood, while endeavoring to make that port.

In an effort to reach the mainland after having been for some time on the shoal, eight persons were drowned; the remainder of the crew and passengers succeeded in reaching land.

Of the eight men lost, three belonged to the surveying party, namely: F. Chadwick, of Simcoe, Rodman; W. Caldwell, of Toronto; and T. D. Taylor, of Orillia, Axeman.

I deem it my duty now, to bring under the notice of yourself and the Government, the cases of these 14 unfortunate men, who lost their lives in the service of the public. Their names are as follows:—

1st.	Wm. Matheson, Packman,	lost by	1st. accident.
2nd.	Alex. Sinclair, "	"	"
3rd.	Half-breeds or Indians. Names unknown.	"	"
4th.		"	"
5th.		"	"
6th.		"	"
7th.		"	"
8th.	A. Hamilton, Esq., in charge,	"	2nd Accident.
9th.	E. J. C. Abbott, Transitman,	"	"
10th.	G. Knout, Chainman,	"	"
11th.	G. Rochette, Packman,	"	"
12th.	F. Chadwick, Rodman,	"	3rd Accident.
13th.	Wm. Caldwell, Axeman,	"	"
14th.	T. D. Taylor, do	"	"

1st. Wm. Matheson, as already stated, no particulars in reference to him could be obtained. He was hired on the 21st June, 1871, at $30.00 per month, and lost his life on the 3rd Aug., 1871. He would, therefore, be entitled to $43.00 and had received on account $2.75, leaving a balance in his favor of $40.25.

Alex. Sinclair was hired at Toronto in the beginning of June, 1871, at $30.00 per month; his wages were paid up to the date of his death, together with an advance of $100.00 to his father; and in addition to this the Government granted the latter $400.00, making the total assistance granted in this case $500.00.

3rd, 4th, 5th, 6th and 7th—Half-breeds or Indians. Their families have been treated in the manner already explained; the assistance afforded their families being equal to about $50.00 for each man lost.

8th. Arthur Hamilton—The circumstances connected with this case are peculiarly distressing, and are as follows: He was sent to Red River on the survey connected with the road from the Lake of the Woods to Fort Garry. At the time of the disturbance in that place he was arrested, by order of Riel, and confined in prison, but after six or eight weeks confinement he made his escape, and returned home in a destitute condition, having lost his clothing, instruments, &c. He made no claim upon the Government for these losses, feeling thankful that he got home in health.

He was hardly settled at home after this, when, by the destructive fires which raged in this part of the country during the summer of 1870, he lost all that he possessed, his wife, child and himself barely escaping with their lives. On the 1st of July, 1871, he joined this Survey, and proceeding to the country north of Lake Huron, completed, during the Summer and Autumn of that year, in a very satisfactory manner, the duties entrusted to him. He was sent up the Ottawa River in the latter part of Februar 1872, remaining out until this Survey was completed, and was on his w home, after a severe winter campaign, when he lost his life, as previous described, on the 20th May, 1872. He leaves a widow and two youn children entirely unprovided for. His salary, $160.00 per month has be paid to his widow up to the 31st of May last, and I have advanced a sm amount in addition.

9th. E. J. C. Abbott—This gentleman was employed on the Surv from the 1st June, 1871, to the date of his death, and was on his way ho after a very hard winter's work. He leaves, I believe, a widowed moth who was, probably to some extent, dependent upon him. His salary w $100 per month, and there remains a balance of $245.18 due his heirs.

10th. Geo. Knout was a young man from Nova Scotia. He was e ployed on the Survey from the 1st June, 1871, to the date of his death, a spent the whole of the winter in the woods. His salary was $35, whi his friends received in full up to the above named date.

11th. G. Rochette was a single man, a French Canadian by birth, a had been on the survey from the 1st Sept., 1871, to the date of his death. His wages were $26.00 per month, which his friends have received in full up to the above date—and in addition 4 months wages granted by Government.

12th. Fred. Chadwick, came from Simcoe and was employed on the survey from the 1st July, 1872, to the date of his death. He was one of eight orphan children, who were, I believe, to some extent, dependent upon him for support. His salary was $40 per month, part had been paid him on account, leaving a balance due to his heirs of $114.56 for services rendered up to the date of his death.

13th. Wm. Caldwell was a single man who was hired for the survey in Nov., 1871, and had only returned home a short time before the accident by which he lost his life. He had been settled with upon his return, and having re-engaged with Mr. Murdoch's party in November last, was lost in the manner already related. His wages were $30 per month.

14th. T. D. Taylor, leaves a wife and several children; was engaged last Nov., and was consequently but a short time in the service when he lost his life.

This closes the list of painful losses; herewith will be found the whole in a tabular form to facilitate reference.

Having thus submitted all the facts in my possession connected with these men, I would respectfully present their several cases for the most favorable consideration of the Government, and at the same time suggest that the course pursued with reference to the volunteers might form a guide on which to act in reference to these parties, as, although dying from different causes, they were yet exposed to great dangers, and perished like the volunteers, in the service of their country. Should the Government see fit to act on this suggestion, I would recommend, in order that the Canadian Pacific Railway—to which the amount would be clearly chargeable—may bear the expense, that instead of granting pensions in these cases, the several amounts, to which the heirs of the deceased would appear to be entitled, be capitalized and paid over for their benefit.

I am, Sir, your obedient servant,
SANDFORD FLEMING, Chief Engineer.

TABLE OF LIVES LOST ON THE CANADIAN PACIFIC RAILWAY SURVEY IN 1871 AND 1872.

WITH DETAILS REFERRING THERETO.

No.	NAME.	RANK.	PAY PER MONTH.		DATE OF Engagement.	DATE OF Death.	Balance due on account of services to time of death.		COMPENSATION. Advanced by Engineer or overpaid.		Paid by Gov'rm'nt.		Total to Date.	
	STAFF.				1871.	1872.	$	cts.	$	c.			$	c.
8	A. Hamilton	Engineer in charge	$160	00	1st July	20th May	....	.....	188	56	....	....	188	56
9	E. J. C. Abbott	Transitman	100	00	1st June	20th May	245	18	....	....	....	....	....	....
					1872.									
12	F. Chadwick	Rodman	40	00	1st July	26th Nov	111	56	....	....	....	....	8	20
					1871.									
10	G. Knout	Chainman	35	00	1st June	20th May	....	.....	8	20	....	....	....	....
	MEN.				1871.	1871.								
1	W. Matheson	Packman	30	00	21st June	3rd Aug	49	25	....	....	....	....	....	....
2	A. Sinclair	Do	30	00	1st June	3rd Aug	....	.....	100	00	100	....	500	00
						1872.								
11	G. Rochette	Do	28	00	1st Sept	20th May	....	.....	....	....	110	00	110	00
13	W. Caldwell	Axeman	30	00	11th Nov	28th Nov	....	.....	20	55	....	....	20	65*
					1872.									
14	J. D. Taylor	Do	30	00	11th Nov	28th Nov	18	00	....	....	....	....	....	....

*Mr. Caldwell received an advance from Engineer in charge, which, after deducting 20 days' pay, leaves $20.65 overpaid.

DEPARTMENT OF PUBLIC WORKS, CANADA.

OTTAWA, JUNE 6TH, 1873.

SIR,—

I beg to send you herewith Copy of an Order in Council, dated 31 May, 1873, authorizing payments of certain sums of money to the rep sentatives of the officers who lost their lives during the Pacific Survey and request that the payments therein authorized may be made forthwi

I have the honor to be,
Sir,
Your Obedient Servant,
F. BRAUN, *Secretary.*

SANDFORD FLEMING, ESQ., C.E.,
C. P. R. S., OTTAWA.

Copy of a Report of a Committee of the Honorable the Privy Council, approv by His Excellency the Governor General in Council, 31*st May*, 1873.

On a Memo. dated 1st March, 1873, from the Hon. the Minister Public Works, representing that the Chief Engineer of the Pacific Railw Survey, in a report dated 28th January last, states that 14 lives were l out of the staff of officers and men employed on the Survey, from t month of August, 1871, to the present date, and relates therein the c cumstances attending these sad losses, and which in brief are stated follows:—

1st. On the 7th of August, 1871, seven men, of whom two were wh and five Indians, were suddenly encompassed by a fire in the woods, nor of Lake Superior, and being unable to effect their escape, perished the

2nd. On the 20th May, 1872, four white men were drowned in La Temiscamingue.

3rd. On the 26th Nov., 1372, three men of the Survey were lost, wi five others, in an endeavour to reach the mainland from the steamer Ma Ward, which had stranded on a shoal in Georgian Bay, near Collingwo

That the names and position of the lost men are as follows:—

A. Hamilton	Engineer.
E. J. C. Abbott	Transitman.
F. Chadwick	Rodman.
G. Knout	Chainbearer.
W. Matthewson	Packman.
A. Sinclair	Do.
G. Rochette	Do.
W, Caldwell	Axeman.
T. D. Taylor	Do.

and the 5 Indians or Half-breeds whose names are unknown.

That the families of these five Indians have been settled with to th satisfaction.

That by authority of an O. C., passed on the 25th May last, the father of A. Sinclair, one of the white victims of the first accident, was paid a sum of $500, which was equivalent to 18 months of his late son's pay.

That in the case of W. Matthewson, the other white victim of the first accident, no particulars could be obtained as regards his family or connections.

The Minister recommends that the representatives of the remaining deceased be settled with on the same terms as were accorded in the case of Sinclair, viz: by allowing them a sum equivalent to 18 months of their late relatives' pay, as follows:—

	Pay per Month.		Mo's.	Am't to be paid Family,
A. Hamilton	$160	×	18	$2880
E. J. C. Abbott	100	×	18	1800
G. Knout	35	×	18	630
G. Roochette	26	×	18	468
F. Chadwick	40	×	18	720
W. Caldwell	30	×	18	540
Total				$7038

The Committee submit the above recommendations for your Excellency's approval—such payments to be charged against appropriation for Pacific Railway Survey.

Certified,

(Signed), W. A. HIMSWORTH,
Clerk P. C.

To the Honourable
The Minister of Public Works,
&c., &c., &c.

STATEMENT of Account in each case, showing balances now payable.

NAME.	Balance of Salary unpaid.	Allowance by Order in Council.	TOTAL.	Advanced or Overpaid.	Balances now payable.
	$	$	$	$	$
A. HAMILTON	....	2880.00	2880.00	188 56	2891.44
E. J. C. ABBOTT	245.18	1800.00	2045.18	....	2045.18
G. KNOUT	....	630.00	630.00	8 20	521.80
G. ROCHETTE	....	468.00	468.00	110.00	358.00
F. CHADWICK	114.56	720.00	834.56	....	834.56
W. CALDWELL	....	540.00	540.00	20.65	519.35

LOSS OF LIFE IN 1873.

CANADIAN PACIFIC RAILWAY,
OTTAWA, 26th January, 1874.

SANDFORD FLEMING, ESQ.,
Engineer-in-Chief.

DEAR SIR,—

I beg to submit the following report of serious accidents which occurred on this work during the past summer, to take the place of one, on the same subject, which was destroyed by the late fire.

The first accident occurred on the 24th July last at Whitefish Lake near the starting point of Division M, 1873. By it three packmen lost their lives, whose names were

Joseph Hughes, Devizes P. O., London, Ontario.
Arthur Torrie, Milleburgh.................... "
Neil Patterson, Napanee......... .... "

The particulars of the accident are as follows:—Three men, namely Joseph Hughes, Arthur Torrie and Henry Thomas, were crossing Whitefish Lake in a small canoe, and when near the depot, which was established on the shore of that lake, the canoe, by some accident, upset in 23 feet of water, about 100 feet from the shore.

Neil Patterson who happened to be standing there and saw the accident, swam bravely out to their assistance, but was seized hold of by Hughes and they both sank together.

A. Torrie also went down about the same time, but Henry Thomas, said to be the poorest swimmer of the three, succeeded in reaching the land.

By this time, some of the men at the depot attracted by the cries, ran down to the beach, but were too late to render any assistance.

It was estimated by these men that the whole thing occurred within three minutes.

Three days afterwards the bodies were recovered and buried in one grave, near the depot, a board being placed at its head, having the names of the men and the date of their death written upon it.

What little personal effects they had were forwarded to the Head Office, Ottawa, and were destroyed in the late fire. They were, however, of little value and consisted of some wearing apparel.

At the date of their deaths the following amounts were due to them for wages :—

J. Hughes..................................	$40 75
A. Torrie....................................	44 79
N. Patterson	29 19

Before concluding the reference to this accident, I would respectfully suggest that, as Neil Patterson lost his life in the effort to save others, his case deserves special consideration.

The second accident occurred on the 21st October, at Red Rock, while the parties were waiting the arrival of a steamer to take them home.

By it a Foreman Packer, Wm. Playter, of Toronto, was lamed for life. He was cutting wood for the camp fires on the above named date when his axe glanced from a tree and cut his foot, severing all the tendons. It was dressed by some of the party to which he belonged, but owing to there being no Surgeon at hand, it was imperfectly done, and when he arrived at Collingwood, it had so far healed as to render it impossible to remedy the defect.

This young man is most highly spoken of, for the manner in which he discharged his duties, by Mr. McConnell, the Engineer in charge of the party; and I can myself bear testimony to the fact that he seemed to be qualified for a higher position than he then occupied.

I had enclosed with my former report, a letter received from him since his, return home, which fully bore out my opinion of him.

If something could be done in the way of procuring for him a position as clerk in an office, I believe it would be more satisfactory to him than a pecuniary consideration.

He was paid in full to the date of his discharge, and I directed that he should be given two months pay extra, amounting to $66.00, to support him until able to move about again.

In addition to the above mentioned loss of life by accident, I regret extremely having to report the loss of two of our "chief commissariat officers in the field;" whose deaths, if not caused' were at least accelerated by unavoidable hardship and exposure to which they were exposed while engaged carrying out their very arduous duties.

The first of these was Mr. John P. Robson, formerly of St. John, N.B., who received an appointment, in the above named capacity, when this work was commenced in 1871, at which time he removed his family to Kingston, Ontario, where they at present reside

During the past summer, Mr. Robson was stationed at Red Rock, Nepigon Bay, Lake Superior. I left him there when I returned to Ottawa for a short time, on the 6th September; and upon going up there again about the 15th October, (I can not speak exactly as to dates, my diary having been destroyed in the fire) I found that he had been taken on board the steamer "Cumberland," the day before my arrival, in an insensible state, and, I subsequently learned, died on the passage down, the day after leaving Red Rock.

The complaint of which he died was, I believe, neuralgia in the head.

Mr. Robson's duties during the past summer, were to receive all supplies brought to Red Rock by steamer, keeping an exact account thereof; he then had to superintend personally the forwarding of them, in such quantities as were required by the Engineer in charge, to the principal depot of each party, in the interior of the country. From which point, the engineer's commissariat officer saw to their being forwarded along the line of exploration.

The number of parties for which Mr. Robson had to provide were four, and the distance of their depots from Red Rock varied from 10 miles to 100 miles.

He had also to keep account of Government and Hudson's Bay Co.'s stores supplied to the men, and the paying off of men who were discharged during the progress of the work.

These various duties, some of which subjected him to considerable hardship and exposure, he performed in a faithful and energetic manner.

In consequence of Mr. Robson's sudden death, considerable difficulty was experienced in closing his accounts.

But with Mr. Price's assistance, this was effected in as correct a manner as possible under the circumstances.

So far as can be recollected, Mr. Robson's account showed a balance against him of about $117.00; this can be accounted for by the facts that his funeral expenses, amounting to $100 00 have been placed to his debit, and also a sum of $45.00, being a payment on power of attorney to one of the men, which was not deducted from the man by Mr. Price when settling with him subsequently, owing to the entry in Mr. Robson's book not being sufficiently explicit for a stranger to understand; although, no doubt, it would have been clear to him had he lived to settle matters himself.

I would therefore respectfully recommend, owing to the peculiar circumstances of the case, that these two sums, amounting to $145.00, be placed to his credit, leaving the balance in his favor $28.00.

Since his death, the sum of $200.00 has been advanced to his family, in anticipation of the usual grant being made to them by Government.

The second commissariat officer, whose death I regret to have to record, was Mr. Nathan L. Price, late of Grand Falls, New Brunswick, where his family still reside. He, also, has been employed in the same capacity, since the commencement of this work in 1871.

His duties were, to receive the supplies for Division M, at Prince Arthur's Landing, Thunder Bay, Lake Superior, and superintend the forwarding of them to the Main Depot of the Division, in the interior of the country, a distance of over 100 miles; also, their distribution to various other depots along the route to be explored. Having performed this difficult service in a most satisfactory manner, he came to Red Rock and, after the departure of Mr. Robson as already described, took charge of affairs at that point; assisting in closing the accounts and paying off the men, upon the completion of the season's work. After the departure of most of the parties from Red Rock, on their way home, he arranged and took stock of all the Government stores, leaving them in good order for next season's operations.

He then returned with me to Ottawa, and while engaged in closing his own and Mr. Robson's accounts was taken ill very suddenly and died in a few days of Hemorigic scurvy; which the doctor who attended him stated was brought on by hardships and exposure while out in the woods

His accounts were all closed in a most satisfactory manner, and at th time of his death there was a balance due to him on account of salary o $327.00, as near as can be remembered.

But of this balance the sum of $200.00 has been sent to his wife sinc his death, and his board bill in Ottawa, $23.00 has also been paid.

Besides these, there is a bill for medical attendance during his la illness of $20.00 and funeral expenses $53.00. Total $73.00 charge against him.

These two last items I would respectfully recommend, as I have also lone in the case of Mr. Robson, should be placed to his credit. I cannot lose this report without expressing my sincere sympathy with the families f these two officers in their sad bereavement. I take the same opportuity, to state that, from the day they joined the service until the date of heir respective deaths, they fulfilled the very arduous duties entrusted to hem in a most trustworthy and satisfactory manner, which duties were of uch a peculiar character that it will difficult to find others to discharge hem.

I remain Dear Sir,
Yours truly,
JAMES H. ROWAN.

CANADIAN PACIFIC RAILWAY.

OFFICE OF THE ENGINEER IN CHIEF,
Ottawa, February 7th, 1874.

The Hon. ALEX. MACKENZIE,
&c., &c., &c.,
Minister of Public Works.

SIR,—

It is my painful duty to bring under your notice some particulars respecting loss of life in connection with Canadian Pacific Railway Survey luring the year 1873.

The accompanying report of Mr. Rowan will be found to give the acts, in each case, as far as known.

I may be permitted to observe that the survey sustained similar losses luring the years 1871 and 1872, for particulars see my report of January 8th, 1873, and the Government passed an order on the 31st May of the ame year, authorizing payment to the representatives of the deceased of n allowance equivalent to eighteen months of their relative pay in each ase.

The names, position and pay of the poor men lost are as follows:—

John P. Robson,	Commissariat Officer	......$100	per month.
Nathaniel L. Price,	do	 100	"
J. Hughes,	Axeman	 30	"
A. Torrie,	do	 30	"
N. Patterson	do	 30	"

In all cases, I have ordered the payment of the expenses connected ith the death and burial of the deceased.

The families of the poor men, depending on their salary for support, ve been left in straitened circumstances, and I have, in some cases, taken on myself to make a small advance on account of any compensatory lowance the Government may please to grant.

From time to time, there have been accidents of various kinds, that rtunately have not resulted fatally, but it is proper that I should allude one of rather a serious nature, as the man injured is lamed for life. The rticulars of this case are also given in the attached Report, the mans me is William Playter, he appears to be a respectable, well educated young man, and an appointment to a position clerk in an office, wou habily be a more satisfactory way of compensating him than a gr money.

I respectfully submit these several cases for the generous con tion of the Government.

I am, &c.,
Your obedient servant,
SANDFORD FLEMIN

Department of Public Works,
Ottawa, February 26th,

Sir,

I beg to herein enclose for your information, copy of an or council, dated the 13th February, 1874, granting an allowance equ to eighteen months' pay to the representatives of the officers an who lost their lives in the Canadian Pacific Railway Survey, duri year 1873.

I am, Sir,
Your obedient servant,
F. BRAUN, Secre

S. Fleming, Esq.,
Chief Engineer C.P.R., Ottawa.

Copy of a Report of a Committee of the Honourable the Privy C approved by His Excellency the Governor General in Cour the 13th February, 1874.

The Committee have had in consideration the memorandum da 11th February, 1874, from the Honourable the Minister of Public stating that the following officers and men, who lost their lives whi ployed on the survey of the Canadian Pacific Railway, during th 1873, viz:—

J. P. Robson,	commissariat officer........	$100	per month.
Nath. L. Price,	do	100	"
J. Hughes,	Axeman................	30	"
A. Torrie,	do	30	"
N. Patterson,	do	30	"

and stating briefly the circumstances attending the same and recom ing that he be authorized to grant to the representatives of these and men, an allowance equivalent to eighteen months of their pay, allowances having been made by order of Your Excellency, date May, 1873, for like losses of life on the said survey, during the year and 1872.

The Minister further represents that William Playter, foreman p salary $33 a month, had his foot so severely injured by the axe, glanced from the tree, that he must remain lame for life, and recom ing that he be employed in the civil service.

The Committee submit the foregoing recommendation for Your lency's approval.

Certified,
(Signed,) W. A. HIMSWOR

LIVES LOST ON THE CANADIAN PACIFIC RAILWAY SURVEYS, 1873,

WITH STATEMENT OF ACCOUNT IN EACH CASE.

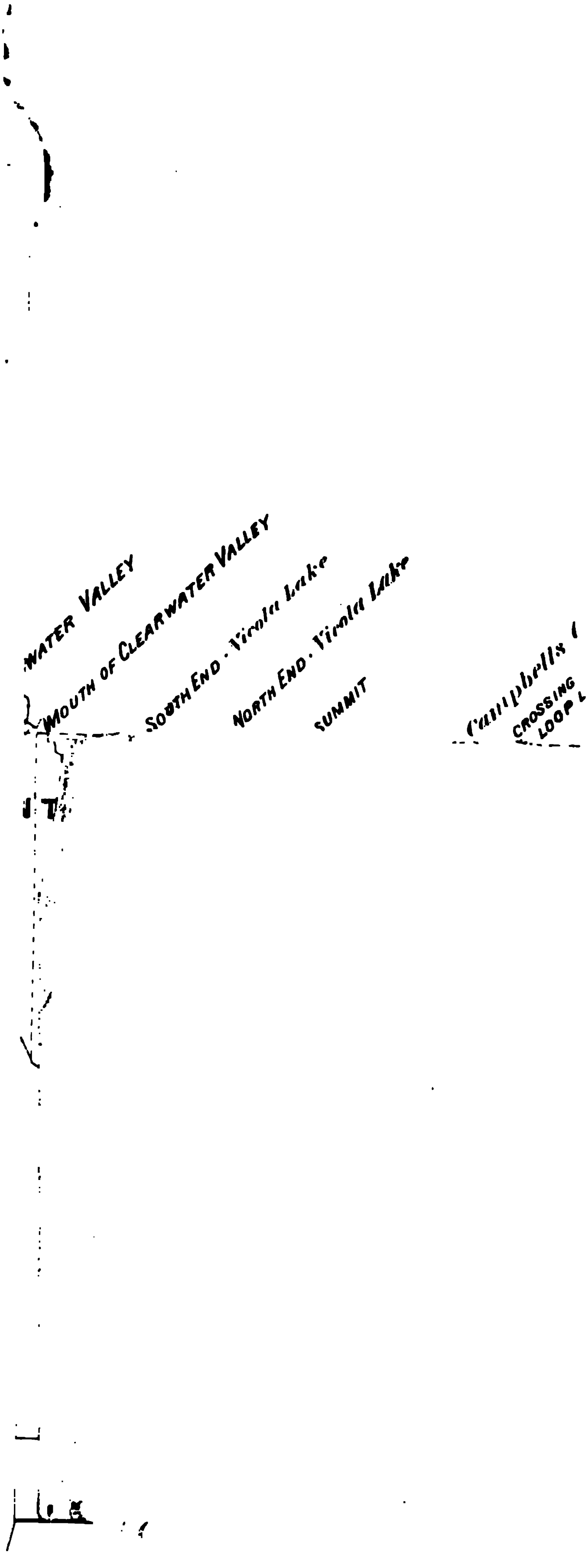
No.	NAME.	RANK.	Pay per month.		Date of		Balance due on account of services to time of death.		COMPENSATION.								Balance now payable	
					Engagement	Death.			Advanced to family on account.		Balance to Debit.		Balance to Credit.		Granted by Order in Council.			
			$	cts.			$	cts.	$	cts.	$	cts.	$	cts.	$	cts.	$	cts.
	Staff.				1871.	1873.												
	John P. Robson.	Commissariat Officer.......	100	00	June.	October 22	28	00	200	00	172	00	....	....	1,800	00	1,628	00
	Nat. L. Price...	do	100	00	June.	December 30	327	00	200	00	....	....	127	00	1,800	00	1,927	00
	Men.				1873.	1873.												
	Joseph Hughes.	Axeman	30	00	June 6	July 21	44	79	44	79	....	....	....	....	540	00	540	00
	Arthur Torrie...	do	30	00	"	"	40	75	....	......	....	....	40	75	540	00	580	75
	Neil Patterson.	do	30	00	"	"	29	19	....	......	....	....	29	19	540	00	569	19

CHARLES O. PALMER,
Accountant.

ABSTRACT.

Lives lost in connection with the Survey during the years 1871, 1872 *and* 1873.

No.	NAME.	Date of Death.		REMARKS.
1	Alexander Sinclair....................	August 7th......	1871	Burned in woods.
2	William Matheson....................	"	"	Burned "
3	Indian, name unknown..............	"	"	Burned "
4	Indian, "	"	"	Burned "
5	Indian, "	"	"	Burned "
6	Indian, "	"	"	Burned "
7	Indian, "	"	"	Burned "
	Indian, "	April 7th.......	1872	Drowned in North Thompson.
9	Arthur Hamilton.....................	May 20th........	"	Drowned in L. Temiscamingue.
10	Edward J. C. Abbott..................	"	"	Drowned "
11	George Knout..........................	"	"	Drowned "
12	George Rochette.......................	"	"	Drowned "
13	Frederick Chadwick..................	November 26th.	"	Drowned in Lake Huron.
14	William Caldwell......................	"	"	Drowned "
15	—— D. Taylor..........................	"	"	Drowned "
16	Michael Cleney	" 13th.	"	Broke through ice.
17	Joseph Hughes	July 24th	1873	Drowned White Fish Lake.
18	Arthur Torrie	"	"	Drowned "
19	Neil Patterson.........................	"	"	Drowned "
20	John P. Robson........................	October 2nd.....	"	Died.
21	Nathaniel L. Price....................	December 30th.	"	Died.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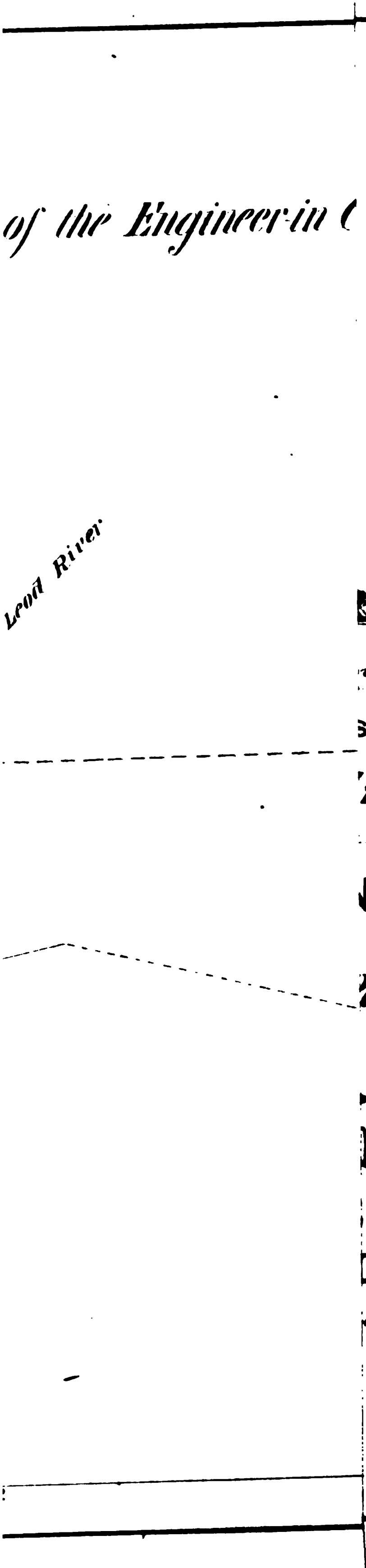

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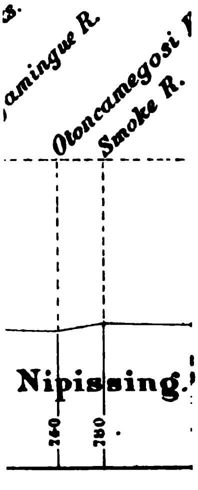

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